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A "Charter of Liberties"

IT IS increasingly evident that the public of this country is to benefit greatly and quite generally from a wider interconnection of electric power plants and from the gradual extension of electric service. As interconnected systems grow, more and more communities and rural areas are supplied with power in an economical and convenient form. As these systems grow in size, it becomes more and more feasible to construct huge steam electric stations of greater economy, to develop larger hydro-electric plants and to build transmission lines to bring power from a distance to the systems.

One of the greatest influences in making developments of this sort possible, as all electrical men appreciate and as all responsible men in public position know, has been the federal water-power act. This act is more and more understood to provide the opportunity for the public and the utilities expert in power work to develop the latent water power of the country for the best interests of the people. The more experience there is in the development of power, the more it is apparent that it is a problem of mutual interest and benefit to the public and utility.

But the situation presents its mutual obligations as well as its mutual opportunities. This point was ably made last week at the Pennsylvania Electric Association convention by Deputy Attorney-General Philip P. Wells, a member of Governor Pinchot's Power Survey Board, speaking officially as to Pennsylvania's attitude in this undertaking. Part of his remarks are given in the news pages of this paper. Characterizing the federal water-power act as a "Charter of Liberties" under which power development could be made for the benefit of all, he called on utilities to make good their prophecies of a new era of general power supply. But at the same time he told of the obligations of the state to see that all power was developed with a full comprehension of its relation to general supply and that state lines as well as the limits of company territories must prove no barriers to the development of real systems of power. Already, said Mr. Wells, Pennsylvania "has secured the cooperation of some fifteen states" to defend the "Charter of Liberties" against the attack of New York State in the Supreme Court of the United States.

Pennsylvania's "Giant Power Survey" is to be undertaken as a duty of the state so that its citizens may be assured that any power development made under the federal water-power act, as well as any general development of steam stations in the coal fields, will be in their interest. It is a co-operative effort—with the state expressing full confidence in the electrical industry—to develop the state's resources to the people's benefit.

With such foresight on the part of the public there can be naught but encouragement to utilities to do all in their power to bring to a realization the opportunities offered by the "Charter of Liberties." Leaders of the industry who have prophesied the era of superpower development have not spoken without thought and knowledge of the possibilities. It will not come without great effort. But it will come if the brilliant achievements of the past era are any precedent.

Ralph Davenport Mershon

Whose independence of thought and personality have marked his many original contributions to the electrical industry in invention, in practical engineering and in association and other co-operative work.

MANY engineers use the results of development work of others and apply them in new combinations, with intelligent ingenuity and with great professional technique and skill. The real advance of engineering science, however, is produced by those engineers who think for themselves, who contribute a unique creative ability to the problems which confront them. In this latter class one of the most independent thinkers in the electrical engineering field is Ralph D. Mershon. While consistent in basing his work on sound technical training and adherence to fundamental principles, yet he approaches a problem with a vigorous determination to find his own solution whether it agrees with previously accepted practice or not. He is thought of perhaps most widely, at least among the younger generation of engineers, as the originator of the Mershon diagram, which is at once both a simple and a practical method of calculating transmission-line characteristics. His more important original contributions to the industry have been the six-phase rotary converter, the compound rotary converter and the compensating voltmeter. His original contributions, however, have not been limited alone to apparatus and devices, but are also evident in the larger engineering undertakings for which he has been responsible in various places scattered all over the world.

Not the least of his contributions in technical lines are actually but little known because they were made by him as lieutenant-colonel in the Engineers Corps during the late war, when he served as the executive officer in charge of most of the research work of the special problems committee of the Naval Consulting Board. In this position not only did he direct the work done under the auspices of the committee but he also made notable original contributions to this work, all of which were of material value to the country in the conduct of the war.

MR. MERSHON is a native of Ohio and a graduate of Ohio State University. While still a student he devised a method of determining wave shape by using the telephone as an auxiliary in the "contact" method, long before the oscillograph appeared. After a short experience of teaching at Ohio State he became associated with the Westinghouse Electric & Manufacturing Company in 1891, leaving in 1900 to take up independent practice as a consulting engineer. Mr. Mershon was the designer of a Westinghouse transformer for which a special award was made at the Chicago Exposition in 1893. He was in charge of various pieces of power transmission work for the Telluride (Col.) Power Transmission (where he made, in 1897, the first important measurements of corona loss), for the Colorado Electric Power Company, the Montreal & St. Lawrence Light & Power Company, the Shawinigan Water & Power Company, the Montreal Street Railway Company, the Niagara, Lockport & Ontario Power Company, the Mawashiro Hydro-Electric Power Company in Japan, the Laurentide Power Company, and the Victoria Falls Power Company in South Africa.

He is author of various articles on generators, transformers and transmission problems. He has been the recipient of both the Edison medal and the John Scott medal. He served the American Institute of Electrical Engineers in various official capacities, being president in 1912-1913. He was a member of the joint national committee Officers' Reserve Corps of Engineers and still retains his commission as lieutenant-colonel of engineers, O.R.C., U.S.A. He is a fellow of the American Institute of Electrical Engineers, a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, Eletrochemical Society, Franklin Institute, Society of Canadian Civil Engineers, Institution of Electrical Engineers (British) and the Société Française des Électriciens, a fellow of the American Association for the Advancement of Science and a member and past-president of the Inventors' Guild. He is a member of the following clubs: University, Engineers', Sleepy Hollow Country and Railroad (all of New York), St. James (Montreal) and Shawinigan (Canada).

Editorial Comment

Electrical World, September 15, 1923

Volume 82 Number 11

Helpful Hints from Commissioner Guests

THE increasing presence of utility commissioners at national and regional conventions of the central-station industry marks the growth of a wholesome and an enjoyable relationship. Not so long ago the acceptance of a convention invitation by a commissioner was prone to be misunderstood by the public in some localities, and in some districts it was a rare experience to see a member of a regulatory body under a convention roof from one year's end to another. All this is changing rapidly, and to the triple benefit of electrical men and women, commissioners and public.

Those of us who live and move and have our being in the atmosphere of electrical development know how large a percentage of executive and subordinate time is spent at conventions upon trying to solve the problems of how better to serve the public; but those a little removed from the actual conduct of affairs often fail to realize the earnest effort which the industry is making to increase its usefulness. It is a fair assumption that a commissioner goes back to his office with a refreshed sense of confidence in the high aims of our industry after attending such conventions as those of the New England Division of the N. E. L. A. held last week at Swampscott and the Pennsylvania Electric Association at Bedford Springs. As such officials represent the public as a part of their functions, the people at large are real gainers from the commissioners' observations. On the other hand, the utilities are fortunate to receive the friendly suggestions of their guests from the state capitols, and great possibilities for good in public relations lurk within the testing of practical hints toward better service in all its aspects through open-minded management. The modern commissioner has an expert knowledge of public opinion, and the utility executive who turns this to account by thoughtful attention to the commissioner's utterances and follows this up by putting good suggestions to work derives a benefit that would be difficult indeed to appraise.

The Significance of Estimated Costs

COST estimating is a perennial task of the designing engineer responsible for successful hydro-electric development. Elsewhere in this issue are presented the details of the New England Power Company's anticipated investment at Davis Bridge, which form an interesting supplement to the description of this development published in this journal on June 16 last. About one-half the estimated initial outlay had been expended when the latter article was printed. The installation is proceeding so rapidly that it is believed the days of spring-flow losses on a large scale on the upper Deerfield River are ended, and within a few months another powerful factor in coal saving for New England will be at work.

The question naturally arises, why publish such an extended estimate before the job is completed? The answer lies in the high reputation of this company's engineers and their comprehensive experience in hydro-electric development in this particular territory for years, embracing the construction of some half-dozen stations with about 75,000 kw. combined rating. Careful cost accounting has gone hand in hand with skillful engineering and bold construction ability, resulting in well-conceived and conscientiously built installations which have aroused the admiration of visitors from many other sections. Again, these data are fresh from the field and from the designers' tables, and in this period of shifting costs it is useful to know what expert opinion counts upon in subdivided construction and equipment expenses for given projects. Close comparisons of either estimated or final costs with those on other jobs in other parts of the world are always to be made with a due sense of engineering perspective, but given this, few data are more stimulating or suggestive than the kind illustrated here.

Standardization of Service Connections

NOT many years ago customers' services consisted only of main service fuses, a main switch and a meter. Fuses and main switches were exposed and not necessarily a unit, meters were often separated from them, and the use of open wiring for connections was prevalent. Meter tests, when made, could be accomplished only after making changes in connections. Since that time radical changes in practice have been made by force of economic pressure, on account of regulations regarding fire and safety, and more recently because of the companies' pride in everything which represents their service. Exposed live parts have rapidly been eliminated, means have been developed to reduce installation and maintenance costs, protection against the theft of energy has been installed, facilities have been provided for meter tests, and load fuses have been made accessible to consumers without endangering meters. In fact, many companies have come to realize that the service equipment is such an important factor in their relations with consumers that the company itself should either install the service equipment or demand that types approved by it be installed. In spite of this progress, so many types of apparatus which have to be combined to make a service installation have been developed that there are almost as many varieties of installations as there are customers. The matter has been made worse in some localities by allowing contractors or consumers to pick their own service equipment.

Most companies today are willing and anxious to standardize service installations; but many of them are waiting for the appearance of something which will combine to their satisfaction the good features of all

existing equipment and have the additional advantage of being inexpensive to install and maintain. They will, therefore, hail as a valuable experiment the effort of four leading manufacturers, announced last week, to provide, through a system of interlicensing of patents, a standardized service unit, which is said to be an advance over previous practice in that it combines in one compact cabinet all the functions now performed by separate units for complete service connection and segregation of a limited number of circuits for distribution. Actual standardization, of course, can come only when all manufacturers can unite on a common manufacturing program. While many central-station engineers feel that there is so much still to be done that the time for standardization has not arrived, nevertheless progressive companies will be sure to give serious consideration to the proposed unit, now that a definite move toward standardization has been made.

There should be no fear that standardization will hamper advance. No one contends that no further progress can be made in any line because standardization is started. In the case at hand the service unit includes most of the features which seem desirable, judging, of course, without knowledge of the developments which the next few years will bring. Possibly these years will show an increase of residence loads so great that circuit breakers and not fuses will be needed on main circuits; possibly, too, radically new equipment of various sorts may modify demands upon service installation equipment. In any event this point should be clear—that only by trial and experiment will the weakness or strength of any proposed standard be brought to light.

The problem of adequacy, safety, convenience, appearance and cost of service installations is one of such magnitude that all central-station men, and contractors and manufacturers as well, can afford to give it earnest attention. If a standardization of equipment shall be found which affords a satisfactory solution, it will be only through the co-operation of all those whose interests are affected. The fact that all will benefit from such a solution should be an encouragement to co-operative study.

Emergency Service of Hydro Plants Not a Matter of Dollars

TOO frequently the addition of a hydro-electric plant to a system supplied from steam stations is accepted or rejected on the basis of installation and operating costs. Consideration should also be given to the fact that in many instances of practical experience these hydro stations give an added element of reliability to the service of the system which is very valuable.

Even in low-water stages, if there is any pond at all, the hydraulic station is waiting for the emergency call. Should a big steam turbine develop a minor trouble that requires shutdown for repair, or should some other equipment fail in the steam stations, the hydro-electric plant can be called upon. In other cases the system steam-reserve capacity can be reduced, and in still others the operation of the hydro-electric units as condensers is often equivalent to adding steam generating capacity to the system.

Thus in making analyses of system developments not only should the installation and operating costs of a hydro-electric plant be figured, but also the intangible elements mentioned should be evaluated and placed on the balance sheets.

Why Some Central Stations Have Trouble

THREE letters which tell their own story are printed in the "Central Station Business" department of this paper, page 549, this week. The only comment that is necessary is that a better exemplification of a "public-be-damned" policy would be hard to find.

It is not to be wondered that the company concerned, which operates in a New England city known for its industrial development, is in disfavor with its public. Surely any genuine seeker for information from a business house is entitled to courtesy, and it is probable that the manager who had the hardihood to sign such a letter would be the loudest in protest if some one should return the same sort of an uncivil answer to a courteous inquiry made by him. It is unfortunate that such men are to be found in the public utility business.

Why Should Railroads Not Be Reasonable in Agreements About Crossings?

CERTAIN steam railroads, particularly in the eastern part of the United States, which in the past have taken a rather uncalled-for attitude in the matter of overhead wire crossings, have received a setback by a recent decision of the Illinois Commerce Commission. The attitude of these roads has been one of demanding all sorts of stipulations in agreements, some of them almost prohibitive in character. In fact, the requirements in some cases are so stringent that it almost seems as if they are intended to be prohibitive. In the case in question, the Chicago & Alton Railroad Company asked the Illinois Commerce Commission to force the Spring Valley Utilities Company to sign agreements to maintain the crossing in compliance with the commission rules. The commission took the position that nothing in the law or the commission practices would require the companies to enter into such an agreement, and that whether such an agreement could be required was a case for determination in a competent court of law. The commission pointed out, in addition, that from the standpoint of safety no such agreement was necessary since the commission's rules must be complied with in any case.

There are two distinct cases involved in consideration of the crossing problem. One is that of a crossing over the railroad right-of-way at a point where there is no intersecting highway. This involves the provision of service by two utilities, the railroad and the power company, and the solution should be arrived at as with problems of other kinds—in the interests of all users of service. The situation is one involving the crossing of two rights-of-way, both devoted to public service; but in the past, unfortunately, the railroad companies have felt that they were in a position to ask whatever agreement seemed reasonable to them. The other case is that of a wire crossing at the same point as a highway crossing and within the limits of the highway on which the wire-using utility has a franchise. While this case, too, involves the same provision of service by two utilities, yet railroads have apparently been willing to admit that it is one in which the power companies have more standing.

In both cases it should be remembered that commission rules are established for the purpose of rendering all crossings safe, and that in case of defects in the rules the commission has full authority to establish safe practices. Involved in the problem is the question

of giving the public both railway and other utility service with the least possible restriction compatible with safety. Railway companies have no legal or moral right to load another utility with restrictive requirements that competent regulatory bodies have decided to be unnecessary. Nor have they popular approval in doing so. This applies particularly to two requirements insisted on rather frequently—that of a rental charge on an annual basis for each crossing and in some cases a stiff charge for the drawing of the agreements. There has been a small group of die-hard conservatives in the railway field who have sought to impose all sorts of severe requirements on wire crossings, and these men have not been at all satisfied with the requirements of the National Electrical Safety Code, which ought to be the final authority in all differences of opinion on this subject. It will pay some of these men to look on the question from the standpoint of public interest and to be a little less radical in their demands. The courts will finally decide the matter on the basis of the best interests of the whole public. But how much better it would be to decide without the help of the courts. There is enough engineering ability in the industry to reach a decision at a much less cost than will be incurred by legal action.

Multiple Arresters for Distribution Circuits

LIGHTNING neither strikes twice in the same place nor acts twice in the same manner. On this theory only can field reports of lightning-arrester behavior be reconciled. While specialists argue about what constitutes the best type and discuss discharge rate, gap design and mechanical construction, the men in the field use the arresters on the market and meet to compare notes. But the comparison brings no definite results, for a failure on a certain installation of one type of arrester can be offset—frequently, in fact, on the same property—by perfect behavior on another installation. System men call troubles which are not understandable "ghosts," and it is apparent that lightning must be a ghost.

But the evidence is overwhelming that arresters do protect equipment in the majority of cases, and this independently of the commercial type of arrester now used. While each engineer and each system may have his or its own particular preference as to the best type, all use arresters.

The particular value of an arrester is that it protects equipment against breakdowns and is the cheapest means for accomplishing this result, and it would seem logical, judging from a study of recent papers and field notes, to use multiple rather than single arrester installations on a system. Wherever apparatus involving a worth-while investment cost is exposed to lightning, an analysis should be made to determine the economic feasibility of an arrester installation. Although the arrester may not protect the equipment in certain extreme cases, yet it does give at least a six-to-one or eight-to-one chance of accomplishing that end.

Following out this line of reasoning, arresters should be placed at least on all the large transformers in the distribution system, and the existing practice in high-tension arrester installations should be carried to a greater extent down into the distribution system. It may even prove economical to use multiple instead of single installations on a given line or feeder independently of the transformers connected.

Local Electrical Leagues

TWO very interesting facts are beginning to stand out more and more clearly against the background of the discussion that for so long a time has been carried on upon the subject of central-station merchandising—first, appliances are not now being sold fast enough really to make headway with the important job of equipping the homes of America electrically; second, the trend of evolution does not seem to promise that the electrical contractor and dealer alone can adequately develop the market that lies waiting, but it does indicate an increasing participation by hardware, department and other non-electrical stores.

Central-station executives are going to find themselves impelled to give attention to the study of this problem. For it concerns them vitally.

By way of illustration, S. M. Kennedy, vice-president Southern California Edison Company, says in an interview published in this issue that probably more than forty thousand residence and commercial customers will be connected to that company's lines this year. Already this company has four hundred thousand household appliances on the circuits. Analysis has convinced the officials that this load produces an income averaging one cent a day per appliance. They want as many appliances as possible sold to the forty thousand new consumers gained this year, but some time ago the company withdrew from appliance merchandising, and Mr. Kennedy says that nobody today is aggressively going after this business.

At the same time R. S. Hale, chairman of the N. E. L. A. wiring committee, has discovered in a recent survey that with the increase in the electrical saturation of cities through the wiring of the houses the proportion of "curbstone" contractors is increasing. This indicates that this whole question of local trade relations is one of steadily increasing importance. For the electrical family of most communities is not well harmonized and organized as yet for carrying forward the tremendous task of equipping the American home electrically. And the situation is being complicated no little by the entry of the non-electrical store upon the scene. The department store and the contractor are both elements in the public relations of the modern central-station company no matter what the company's individual merchandising policy may be.

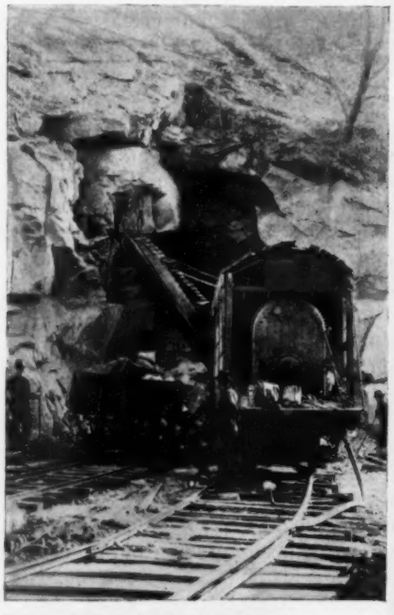
Next week the second annual conference of local electrical leagues will be held on Association Island at the invitation of the Society for Electrical Development. What will be accomplished, how soon, if at all, the associated local leagues will come to be a national factor in the electrical industry, no one can say. But they are growing apparently both in number and in strength, and they seem to offer the logical mechanism for the development of co-ordinated policies among the electrical men of any individual city.

The local electrical leagues are worth watching. Moreover, it is exceedingly important that central-station executives shall not only give them encouragement but personally take the initiative in guiding these leagues in their formative period, so that they may become an influence that will serve both in the expansion of the common market and the cultivation of better public relations from which the whole industry benefits.

Electrical men of every class frankly recognize the fact that the central-station manager must be the leader in this work of local organization.

Wrong Impressions Corrected by Pictures and Data

THE opinion is often expressed among the uninformed that electricity developed from water power should be cheaper than that from steam power. Every company has pictures and figures which can be used to correct this wrong impression if sufficient publicity is given to them. Construction pictures are particularly impressive if accompanied by a few pertinent data indicating the amount of labor, special equipment, time and supervision required for the work. Take, for example, road construction through rocky country for transportation of men, construction materials, etc., used on hydro-electric undertakings.



Besides pointing out the time required for preliminary surveys, attention can be called to the vast amount of rock that must be excavated, the expense of equipment and labor for doing it, the length of the roads, etc. The fact that such roads may cost from $40,000 to $60,000 per mile will astound a great many people.

Similar information on the cost of constructing dams and tunnels would be enlightening. Then, too, some of the more expensive pieces of equipment, such as waterwheel generators, transformers and circuit breakers, could be shown with cost figures and emphasis placed on the fact that they constitute only a small part of the total expense.

Status of Pulverized Fuel

Decreased Losses and Greater Flexibility in Operation Are Admitted Advantages from Its Utilization—Typical Installations and Trends in Development —Advantages and Disadvantages Outlined

By L. W. W. MORROW
Associate Editor ELECTRICAL WORLD

WHERE fuels from different sources are burned, where the constituents in the fuel vary, and where combustion conditions must be maintained at the highest efficiency under all operating conditions, pulverized-fuel installations have certain clearly marked advantages.

These advantages have resulted in the recent adoption of pulverized-fuel equipment by some of the most modern central-station organizations after they had made complete analyses of the merits of the equipment in comparison with other types of combustion apparatus. The fact that these decisions have been made, however, is not a good reason for the universal use of pulverized-fuel equipment, because the further fact that other equally progressive central-station companies have decided to use stokers in new plants shows that there are other conditions to be considered. Yet the statement may be made that, although the power-station art is ever changing and although a designer is very rash who predicts conditions even five years in advance, the trend at present is toward the use of pulverized-fuel.

A calm analysis of conditions shows a field of operation for both stoker and pulverized-fuel installations and in addition the possibility of a great amount of development in the engineering and mechanical features of each type of installation. Therefore, it is as yet unsafe to generalize, and each installation should be the subject of analysis before a decision is made.

ADVANTAGES OUTLINED

A study of the plants using or proposing to use pulverized fuel shows that one or more of the following advantages led to the decision:

1. Many plants are forced to use fuel from many different sources, and the pulverized-fuel equipment is best adapted for operation under these conditions because high combustion efficiency can be maintained. This is because the mechanical equipment needs no readjustments when different fuels are used, and, because of the type of combustion, the control of the fuel-feeding rate, air supply and combustion mixture can be made quickly and easily if the fuel quality varies at any time.

2. Where loads must be dropped or picked up very quickly and where boiler ratings vary widely throughout the day, pulverized coal is a splendid fuel to use because there is no time lag in control of the fuel in the furnace chamber. There is no bed of incandescent fuel to be handled and no slow-moving mechanism to change the fuel feeding. Rather, like gas, the pulverized fuel can be turned on or off almost instantly and fed in any desired amount. Included in this advantage is the fact that this type of combustion can be inherently controlled very readily and efficiently through the use of automatic devices which operate through pressure, draft and steam-flow changes.

3. High thermal efficiency is very important in power stations of today because of the high price of fuel and the necessity for conserving national resources. The pulverized-fuel equipment possesses inherent advantages over stokers in this respect because it can be burned with less excess air and consequently higher CO_2 and can eliminate some of the losses existing in other installations. Some of the losses eliminated are, for example, unburned fuel dropping through grates, banking losses and those occurring when boilers are put on or taken off the line, and those losses occurring when boiler steaming conditions are changed. Where the best stoker installations operate with an efficiency of about 76 per cent and 8 to 12 per cent CO_2, pulverized fuel installations realize efficiencies from 83 to 86 per cent with CO_2 from 12 to 15 per cent.

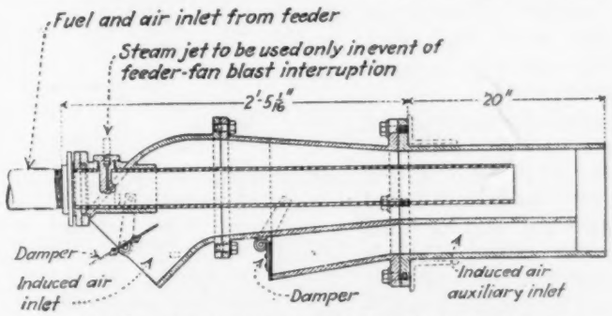


FIG. 1—SECTION OF LOPULCO VERTICAL BURNER

The fuel and primary air enter the burner from the feeder, and a portion of the secondary air is controlled by a damper. One stream of air entirely surrounds the air-cool mixture and stirs and aerates the coal thoroughly before it enters the furnace.

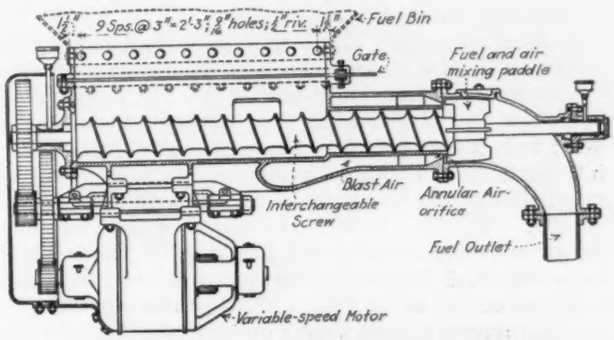


FIG. 2—SECTION OF PULVERIZED-FUEL FEEDER

The screw discharges the fuel into a blast of air which comes from an annular orifice under about 10 in. pressure of water. The revolving-screw shaft mixes the air and coal and passes the mixture on to the burner. About one pound of air per pound of fuel is used at the feeder and the screw is slow-speed, operating at about 4 r.p.m.

Several phases of the subject are open to controversy, however. For example:

1. For the same ratio of boiler rating to kva. rating, pulverized-fuel installations now cost from $1 to $5 more per kva. than stoker installations. It is argued that if credit be given the pulverized-fuel installation for the

savings associated with possible boiler operation at high ratings, the net cost will be equal to or less than stoker-plant costs. Of course, it may be said that stokers also can be forced to give high boiler ratings, but this is said to involve greater investment costs per kva. and larger space dimensions than are necessary when operation takes place at normal ratings. Bearing on the same subject several instances of installations can be cited to show that the total boiler-setting space requirements for pulverized fuel are not greater than with stokers. This is because the ash pits, grates and ash-handling facilities are eliminated and this space saving compensates in a great measure for the additional furnace combustion space and boiler-room fuel equipment space used with pulverized-fuel installations.

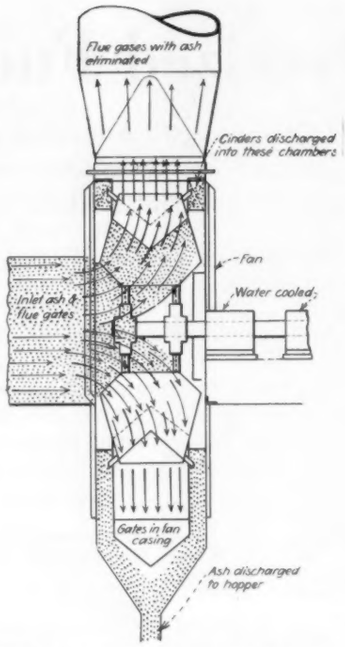


FIG. 3—A SECTION OF THE STURTEVANT CINDER VANE FAN

Centrifugal action separates the cinders and ash from the flue gases when they strike the blade surface. They are then caught in the cinder pocket and delivered by centrifugal action to the settling chambers at the side of the fan housing.

2. Many engineers argue that pulverized-fuel equipment is still in a state of flux and subject to a number of refinements and adjustments before satisfactory operation can be obtained. For example, instead of a 6-ton mill, a 20-ton mill is needed for the large station installations, and much development work is going on in an attempt to enlarge the sizes, but with few positive results. Whether to use concrete or steel fuel bins, air or conveyor systems for handling the fuel, simple or complicated burners, separately fired or stack gas-operated driers or no driers at all—these are subjects of controversy, although each question can be answered in specific cases by results from actual installations.

It is argued that the "shake-down" period for a new plant to achieve maximum efficiency in operation is longer and that improvements in the apparatus are occurring more rapidly with pulverized-fuel equipment than with stokers. In answer, however, the points are made that stoker installations are also in a state of flux, that stokers can be improved very much, and that most of the changes in boiler and furnace practice are occurring independently of the development of fuel equipment. It is asserted, besides, that, whereas a stoker breakdown because of the unit construction used, usually necessitates removing the boiler from the line for repair, a pulverized-fuel installation using fuel-storage bins affords a reserve fuel supply for the boilers in case the mill fails, and this is the part of the equipment that is more apt to fail. For the pulverizing mill and much of the mechanical equipment involved are independent of the boilers and can be repaired or stopped without interrupting boiler operation.

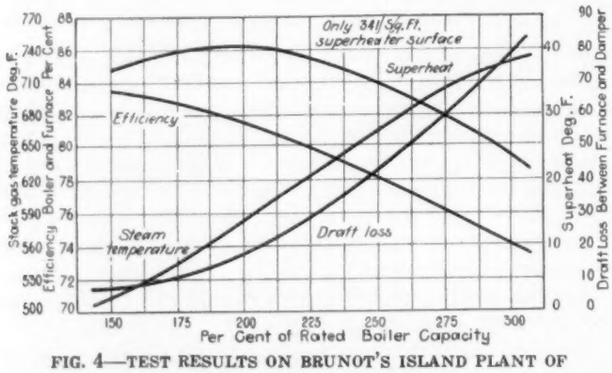


FIG. 4—TEST RESULTS ON BRUNOT'S ISLAND PLANT OF DUQUESNE LIGHT COMPANY

Coal used contained 13,200 B.t.u. as fired, 2.3 per cent moisture, 33 per cent volatile and 2.4 per cent sulphur.

3. The energy required to handle the fuel is greater for pulverized-fuel installations than for stokers. While the stoker energy is 8 kw.-hr. to 10 kw.-hr. per ton, the pulverized-fuel equipment uses from 18 kw.-hr. to 21 kw.-hr. per ton, of which from 15 kw.-hr. to 17 kw.-hr. is used in the pulverizing mill. There does not appear to be any possibility for reducing this energy consumption with any known type of mill; in fact, the larger the masses and the greater the speed of the mill, the greater is the unit energy consumption, because of friction-loss increase. If, however, a type of mill utilizing new principles not involving the movement of heavy masses were developed, the friction load could be eliminated and the consumption of energy reduced greatly. Attempts are now being made to develop mills of this character.

4. Furnace and boiler designs, equipment location and boiler-room arrangements for utilizing pulverized fuel are the subjects of argument and experiment. A study of the proposed installations bears out the statement that each group of plant designers has its own ideas as to the best design and that these ideas differ very much in fundamental points. However, there is no doubt that all of the proposed installations are workable, and it is argued that the same differences in opinions and practices will be found in stoker-fired stations and that the differences deal with the theory of combustion rather than with the pulverized-fuel equipment. The stack effect of the long flame length, the use of water screens, the greater or less furnace temperatures, the location and type of superheater, the use or non-use of driers and the arrangement of burners and combustion chambers are elements that result in differences of opinion and about which it is unsafe to generalize, because neither a theoretical nor an actual background is available to afford a perspective for conclusions.

Thus each of the new stations now under way differs materially from the others and will contribute data which in future installations should permit a realization more quickly of the inherent advantages of pulverized fuel. Even now the location and advantages of convection-type superheaters with pulverized-fuel installations are different from those in stoker-fired plants and new designs and practices are required to attain equally good results in the two cases. For example, in one proposed plant the superheater location is not going to be changed, but the amount of superheater surface will be about doubled as compared with the installation for stoker firing, and these designers argue that the great number of suspended particles in the flame reduce the possibility of radiant-heat absorption. In another plant radiant-type superheaters are to be used inasmuch as

the designers think they possess advantages for radiant-heat absorption in pulverized-fuel plants because of the longer flame length as compared with that available in stoker-fired plants. Other organizations are proposing the use of the ordinary types of superheaters in connection with radiant-type superheaters.

In the large power stations the equipment for pulverizing the fuel may or may not be installed in the boiler room proper. Incoming coal is handled as dictated by the usual practices in stoker-fired plants until after it goes through the crusher, at which time it passes to the coal-preparing plant by means of conveyors, hoists or elevators. The coal-preparing plant consists of the pulverizing mill or mills, exhausters, dust collectors, conveyors, coal bins and screens, or an air-system equipment, and in addition driers in those cases in which they are used.

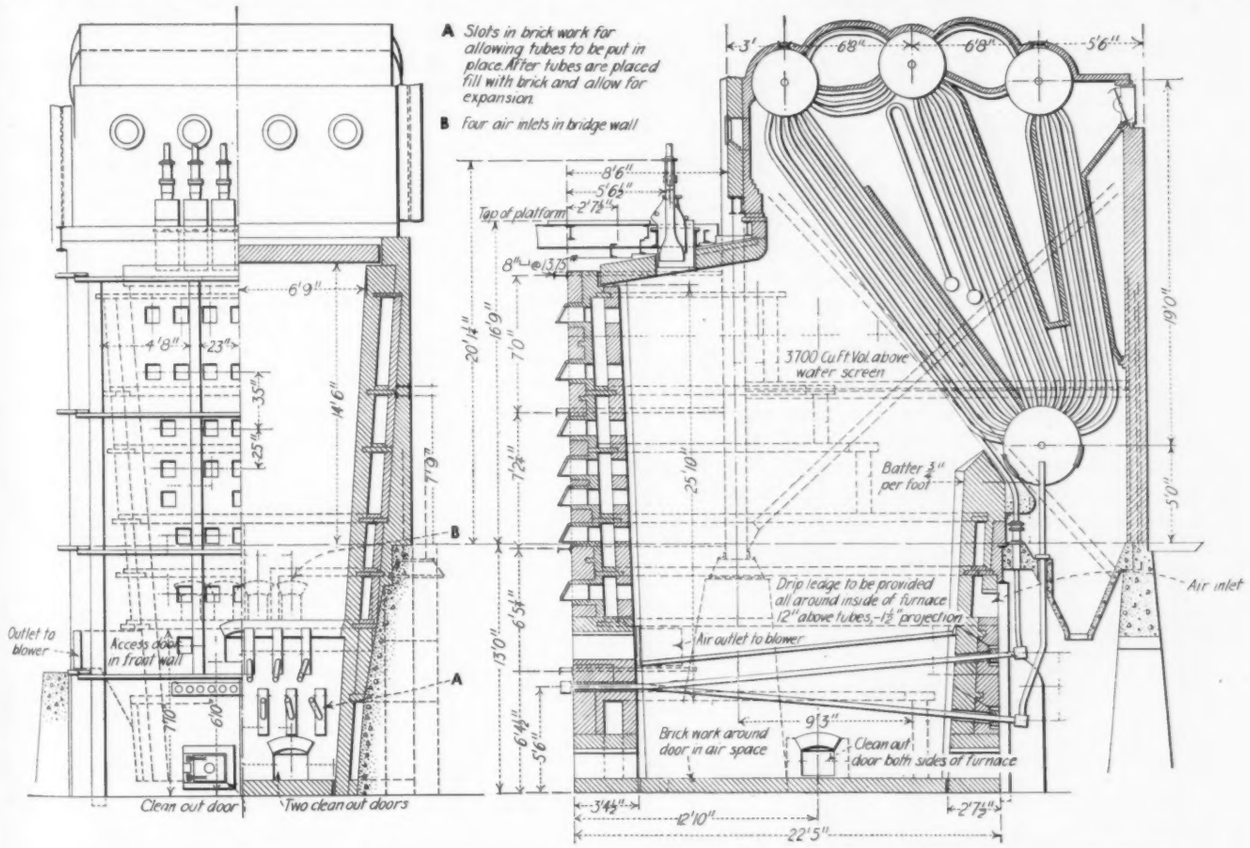

A Slots in brick work for allowing tubes to be put in place. After tubes are placed fill with brick and allow for expansion.
B Four air inlets in bridge wall
Top of platform
3700 Cu Ft Vol above water screen
Batter ¾" per foot
Drip leage to be provided all around inside of furnace 12" above tubes, -1½" projection
Air outlet to blower
Air inlet
Outlet to blower
Access door in front wall
Brick work around door in air space
Clean out door both sides of furnace
Clean out door
Two clean out doors

FIG. 5—CROSS-SECTION OF BOILER INSTALLATION AT BRUNOT'S ISLAND PLANT OF DUQUESNE LIGHT COMPANY

If the superficial moisture in the coal is not greater than about 5 per cent, the fuel can be used without driers, but driers are great assets in keeping the coal from packing in the bins, clogging the conveyors and consuming greater power in handling. Whether driers should be separately fired or use the hot flue gases is a question for analysis, and they are of many types of construction. There is a general desire to eliminate driers, but if this is done, the raw fuel must be delivered without having absorbed moisture or becoming wet during transit and must be kept dry in storage. Fortunately, coal absorbs little moisture, so that it seems possible to develop storage arrangements which will eliminate the use of driers.

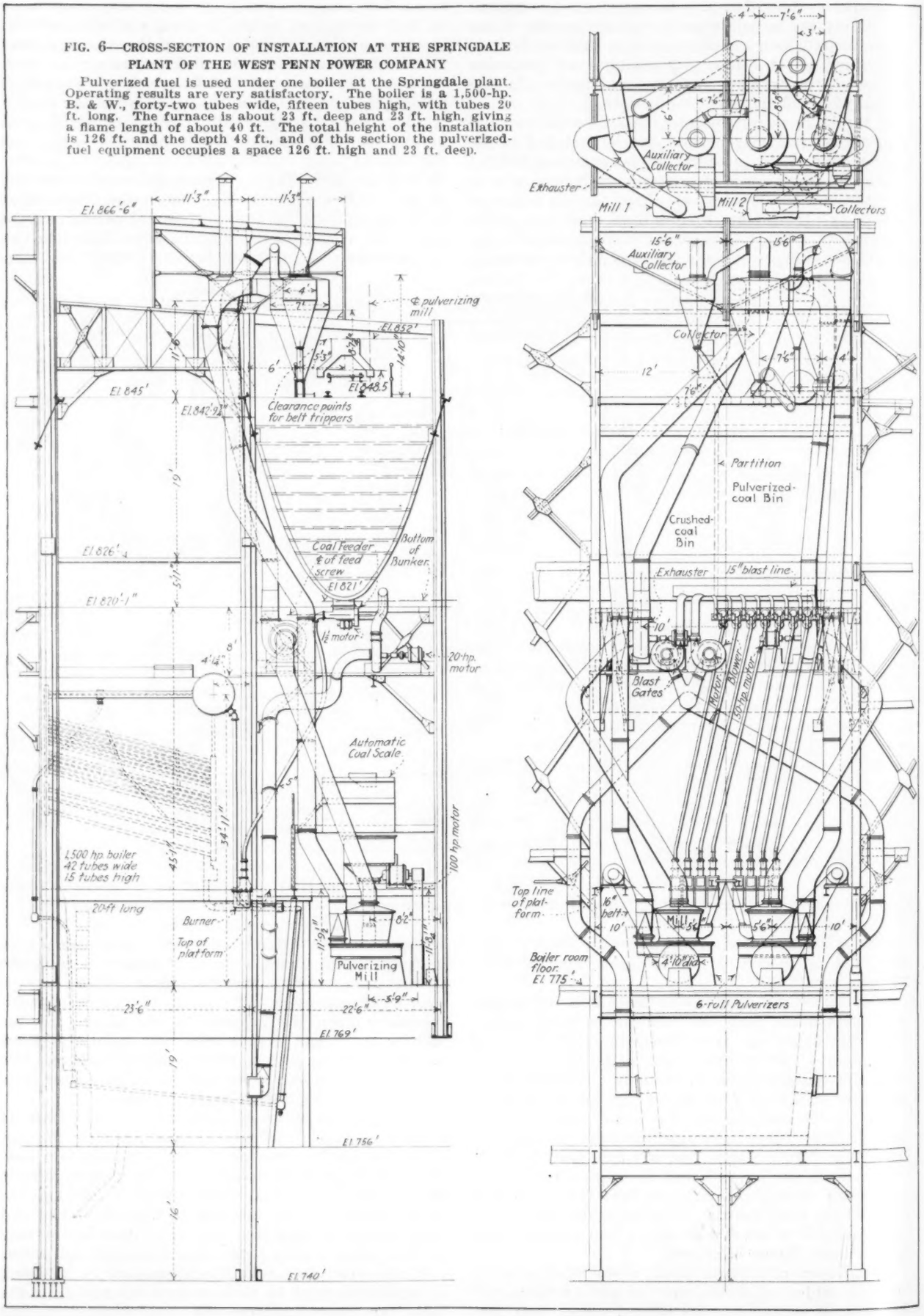
By conveyors of different kinds, whose relative merits form the subject of debate, the fuel goes to the pulvering mills, of which there are several types. The Raymond, Fuller and Aero mills are typical and differ chiefly in their mechanical design, in the use of rolls, balls or cones as crushing agencies, and in the use of screens or air for separating the fuel according to sizes. Although the pulverized fuel fires well when about 65 per cent passes through a 200-mesh screen, the finer it is pulverized (although it will burn more rapidly) the greater the tendency for the ash particles to pass out through the stack and the more the power required to operate the mill. The mills have difficulty in reducing all the coal to a uniform size. Taking the arrangement in a Raymond mill as typical, the coal passes into the base of the pulverizer for crushing and is then lifted by air currents to a separator for eliminating the larger particles of fuel. From the separator the material goes to the collector, where the coal is separated from the air and deposited on a screw conveyor. There may be a series of separators and a series of pulverizing rolls, depending upon the capacity of the plant, and the interior of the mill is kept below atmospheric pressure to eliminate leakage into the external atmosphere. The exhausted air returns to the base of the pulverizer from the exhauster and is used again and again.

From the pulverizer and collector the coal passes on a screw conveyor, through a helical pump or through a compressed-air conveying system to storage bins near the boiler or, as is the practice with one system, directly to the furnaces. Thus much leeway is afforded the plant designer in the selection of type of system and apparatus to be used, and successful installations may be cited using a wide range of systems and equipment.

If the direct feed with compressed air is not used, arrangements must be made to feed the fuel from the bins. To insure uniform and uninterrupted feeding

FIG. 6—CROSS-SECTION OF INSTALLATION AT THE SPRINGDALE PLANT OF THE WEST PENN POWER COMPANY

Pulverized fuel is used under one boiler at the Springdale plant. Operating results are very satisfactory. The boiler is a 1,500-hp. B. & W., forty-two tubes wide, fifteen tubes high, with tubes 20 ft. long. The furnace is about 23 ft. deep and 23 ft. high, giving a flame length of about 40 ft. The total height of the installation is 126 ft. and the depth 48 ft., and of this section the pulverized-fuel equipment occupies a space 126 ft. high and 23 ft. deep.



from bins to furnace is difficult because of variation in moisture content, temperature, fuel demand, fineness and aëration. Screw conveyors in combination with high-pressure and low-pressure air supplies are commonly used, although the direct feed using no conveyor, with the fuel suspended in the air, is frequently encountered.

The bins must have sides with slopes of 60 deg. or more in order to prevent the coal collecting and adhering to the walls. A difference of opinion exists as to the relative merits of steel and concrete bins, for the bin walls should be kept at a higher temperature than the inside atmosphere to prevent condensation and the coal should be kept dry and cool if reliable flowage is to be expected. The concrete bin is reported to have advantages over the steel bin in regard to condensation troubles.

Before the powdered coal is used in the furnace it is thoroughly aërated and mixed and is then supplied to the furnace through an adequate burner. Many types of mixers and burners have been devised using air, steam or the two in combination, and some are complicated devices with multiple nozzles and accessory mixing devices. The shape of the burner nozzle is subject to modification to permit the specific furnace to control the flame distribution and prevent its impingement on refractories or tubes.

The refractories used in the furnaces burning pulverized fuel are the same as those used in stoker-fired plants, but the furnace volume is usually greater and the design of the furnace differs materially. A general tendency is toward the use of hollow-walled and hollow-bottomed furnaces and the cooling of the walls by using air-preheating or water screens connected with the boiler system. The furnace volume and the location and number of the burners are the subjects for much difference of opinion and practice.

The use of water screens, usually in the form of boiler tubes in the bottom and sides of the furnace and connected to the boiler, not only helps to reduce the duty of the refractories but also absorbs heat, and they have their greatest advantage in preventing any slagging of the fuel. Several installations of this type of screen have proved their value and reliability.

Some question has arisen as to the effect of the finely divided ash which emerges from the stacks of pulverized-fuel installations. A certain portion of the ash goes out through the stacks, probably around 40 per cent, but this is in small crystals which are light and are carried great distances and scattered over a wide territory even by light winds. No evidence exists of recent trouble from the pulverized-fuel ash, but fans are being developed for handling it in the event that trouble occurs. Moreover, the Cottrell precipitation process presents possibilities for handling the situation. Most engineers of the larger stations would feel justified in using some ash-removal process, provided it could be operated economically to remove about 85 per cent of the ash.

The first large central station to use pulverized fuel was the Lakeside station of the Milwaukee Electric Railway & Light Company. The Duquesne Light Company, the Puget Sound Power & Light Company, the Narragansett Electric Lighting Company, the West Penn Power Company, the Cleveland Electric Iluminat-

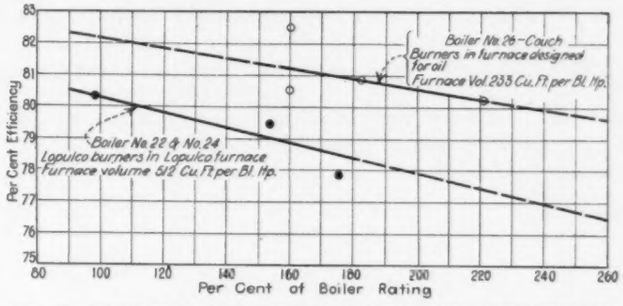

Boiler No. 26—Couch
Burners in furnace designed for oil
Furnace Vol. 233 Cu. Ft. per Bl. Hp.
Boiler No. 22 & No. 24
Lopulco burners in Lopulco furnace
Furnace volume 5.2 Cu. Ft. per Bl. Hp.
Per Cent Efficiency
Per Cent of Boiler Rating

FIG. 7—RESULTS OF PULVERIZED-FUEL-BURNING TESTS AT PLANT OF NARRAGANSETT ELECTRIC LIGHTING COMPANY

Two 600-hp. boilers of the Narragansett Electric Lighting Company are supplied by one pulverized-fuel furnace. The height to the tubes is 25 ft., and the volume is 5,740 cu.ft., or 4.78 cu.ft. per boiler-horsepower. The furnace walls consist of an outer wall of red brick, an air space and a 9-in. lining of firebrick with rowlock setting. Four burners are installed in a vertical position with tips about 22 ft. above the furnace floor. The pulverized-fuel equipment consists of a Pomeroy mill, exhaust fan and a screw conveyor to feed the coal to the mill. The coal does not pass through driers and is fed by gravity directly from the exhauster to the burners with sufficient air introduced to insure combustion and hold it in suspension. The power required by the mill is said to be about 19 kw.-hr. per ton of fuel. Trouble occurred in obtaining arches to withstand the heat, and there was also a tendency to melt the brick lining. Three of the burners gave trouble through coke forming in their ends, and the pier around the front column was replaced twice. The mill proved inadequate for the installation and did not pulverize finely enough. Moreover, too much time was required weekly to clean the ash and slag from the furnace.

RESULTS OF BOILER TESTS AT LAKESIDE POWER STATION, WHERE POWDERED COAL IS USED THROUGHOUT

Tests were made by the Bureau of Mines in co-operation with the Combustion Engineering Corporation. The coal used had a gross B.t.u. of 11,500 to 12,800 per pound, containing 2 to 5 per cent moisture, 33 to 36 per cent volatile matter and 9 to 13 per cent ash, and was ground so that 89 per cent to 95 per cent passed through a 100-mesh screen. The ash had a softening point of 2,150 deg. to 2,450 deg. F.

Test Number	Duration, Hours	Per Cent Rating Based on Heat Absorbed by Boiler and Superheater	Per Cent Efficiency Based on Gross Calorific Value: Boiler and Superheater	Per Cent Efficiency Based on Gross Calorific Value: Boiler, Superheater and Economizer	Per Cent Efficiency Based on Net Calorific Value: Boiler and Superheater	Per Cent Efficiency Based on Net Calorific Value: Boiler, Superheater and Economizer	Temperature Deg. F.: Gases Leaving Boiler	Temperature Deg. F.: Gases Leaving Economizer	Temperature Deg. F.: Superheated Steam	CO_2, Per Cent: Gases Leaving Boiler	CO_2, Per Cent: Gases Leaving Economizer	Coal: Moisture, per Cent	Coal Size: Through Screen, 100 Mesh	Coal Size: Through Screen, 200 Mesh
1	42.33	137	83.3	86.4	86.6	89.8	436	170	547	15.8	10.4	2.2	89	68
2	23.97	216	82.6	87.1	86.1	90.8	470	195	592	14.6	11.9	3.6	91	69
3	19.92	210	82.5	87.1	85.9	90.7	484	204	598	14.7	12.0	3.9	91	69
4	24.37	144	85.3	89.1	89.0	93.0	432	205	529	16.0	13.2	5.6	92	71
5	24.17	236	79.7	84.4	83.1	88.0	500	254	590	14.1	10.8	5.7	91	67
6	28.25	139	83.4	87.6	86.8	91.1	456	229	554	15.1	11.4	3.7	92	68
7	25.57	178	84.0	88.4	87.3	91.9	469	240	561	14.7	11.2	3.5	93	66
8	24.00	176	85.1	89.5	88.5	93.1	470	239	558	15.0	11.4	3.5	92	63
9	24.28	205	83.9	88.4	87.2	91.9	493	256	572	15.1	9.9	2.8	94	73
10	24.62	204	83.4	87.3	86.6	90.7	490	256	565	14.7	10.5	3.5	90	58
11	24.08	243	81.6	86.4	85.0	90.0	535	286	592	14.0	10.2	3.7	95	69
12	23.92	241	82.3	87.0	85.6	90.5	528	263	595	14.3	11.3	4.1	93	69
13	24.25	248	80.9	85.5	84.2	89.0	538	272	601	14.2	9.8	3.6	93	70
14	24.50	130	84.5	88.3	87.9	91.8	440	218	521	17.1	14.7	3.2	93	65
15	17.63	136	84.7	88.8	88.0	92.3	444	221	538	16.4	14.0	3.6	92	65
16	24.15	251	83.8	88.8	87.4	92.6	530	256	612	14.8	11.2	5.5	91	68
17	23.45	238	82.3	87.6	85.7	91.2	528	268	605	14.1	9.9	4.9	92	65
18	24.67	257	82.1	86.9	85.4	90.4	526	269	594	14.9	10.9	3.4	93	70
19	27.38	256	82.8	87.6	86.1	91.0	519	262	588	15.0	11.6	3.1	93	64
20	26.67	251	79.5	84.5	82.6	87.8	545	306	594	13.9	11.8	2.2	92	67
21	23.93	175	86.9	91.3	90.3	94.8	468	260	563	15.6	13.8	2.2	93	72
22	24.42	167	86.2	90.4	89.5	93.9	463	264	564	15.7	13.7	2.5	92	70
23	24.83	233	81.8	86.2	85.0	89.6	526	298	595	13.7	11.4	2.8	92	57
24	25.00	224	81.2	85.9	84.4	89.3	512	294	588	13.1	10.9	2.8	91	69
25	24.03	170	85.4	89.3	88.8	92.9	464	254	562	15.7	13.9	3.5	92	66
26	25.55	166	86.0	89.9	89.4	93.4	459	252	566	15.4	13.6	3.4	92	70

Note—No time elapsed between tests which are bracketed together.

ing Company and the Detroit Edison Company have done a great amount of experimental work or carried on investigations which have convinced them that pulverized fuel should be used in extensions or for new stations. In many details the groups of actual experimenters differ about the best equipment and reach divergent conclusions, but all agree on the inherent general advantages of pulverized-fuel burning for high-load-factor stations and are optimistic about successfully solving details of installation and operation in the contemplated plants. Great credit should be given also to the manufacturers of pulverized-fuel equipment for their very courageous development of the systems for which their initiative and foresight is largely responsible.

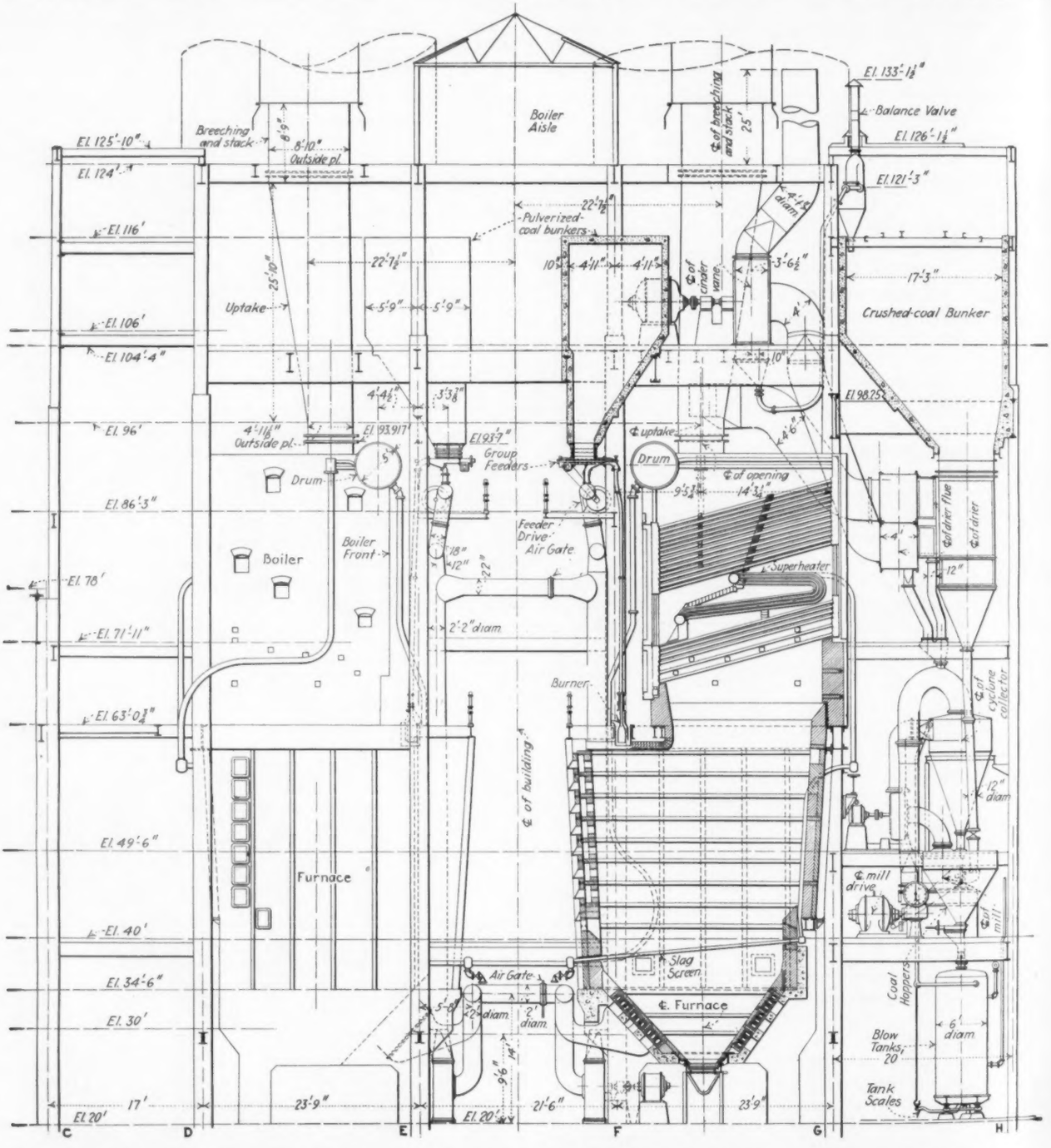


FIG. 8—CROSS-SECTION OF INSTALLATION AT CAHOKIA STATION OF UNION ELECTRIC LIGHT & POWER COMPANY IN ST. LOUIS

This station will burn pulverized fuel and was one of the first of the new stations to use this type of firing. In the station eight boilers, each with 18,000 sq.ft. of heating surface, are installed for 200 per cent rating during normal operation, with 300 per cent operation on peaks. Steam pressure of 300 lb. will be used, with a steam temperature of about 700 deg. All the pulverized-fuel preparation plant is in the boiler room. The incoming coal goes over track scales to a Bradford breaker and then on belts to two vertical conveyors of the same total capacity as the breaker. Then belts of one-half this capacity carry the fuel to the raw-coal bunkers, whence it is delivered by gravity to pulverizing mills. From the mills it goes to small hoppers and thence to a Quigley transport system, including a 4-ton blowing and weighing tank for each unit. From each tank the fuel goes through a 4-in. pipe to the bunkers, one of which is installed in front of and above each boiler. Each bunker holds 75 tons of fuel. One pulverizing mill is used for each boiler unit with two spares held as reserves. Natural draft is used in the plant and no economizers are installed. Cinder vane fans are installed in the flues.

The furnace depth is about 23 ft. and height 32 ft. giving a flame length of about 45 ft. Water screens are used in the rear and bottom of the combustion chamber and air-cooled walls are also used. The total height of the installation is 84 ft. and the pulverized-fuel equipment occupies a section 20 ft. deep and 76 ft. high.

Probably the earliest installation was that of the steam-heating station of the Puget Sound Power & Light Company, which installed horizontal burners under ten boilers with a total heating surface of 41,000 sq.ft. On the largest boiler the combustion volume is 2.7 cu.ft. per boiler-hp., and average operating conditions at normal rating give efficiency of 79 per cent with 10.5 per cent CO_2 and a flue-gas temperature of 535 deg. F. Fuller mills and indirectly fired driers are used in the station. The total maintenance and operating cost for 1921 was 71 cents per ton of fuel, not including overhead, depreciation, etc. The station experiences indicate that concrete bunkers are better than steel because the coal can be kept in storage twice as long without heating. Moreover, definite furnace temperature limitations to 14 per cent. Experience shows that if the coal is raised to about 180 deg. during the thirty minutes required for it to pass through the drier, sufficient moisture will have been eliminated to secure satisfactory operation. A fineness of 65 per cent through 200 mesh has been found satisfactory for burning the fuel at highest efficiency. The Lopulco system of feeders, burners and furnaces is used in the plant. The screw conveyors, mill discharge and return piping, pulverized-fuel bins and supply lines have been covered with insulation to prevent the condensation of warm vapor rising from the coal. About 18 in. of air pressure is used in the primary air header and the feeder pipes are being equipped with steam nozzles to aid in mixing and feeding the fuel. The furnace uses hollow walls and

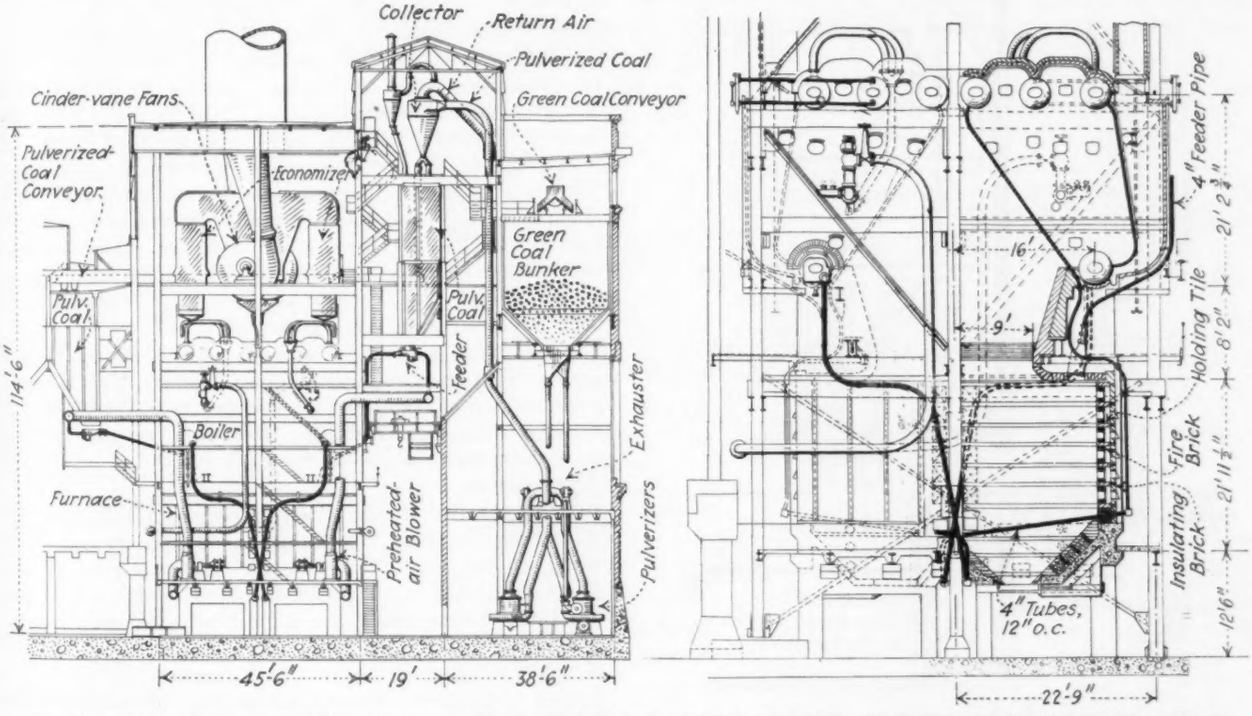


FIG. 9—CROSS-SECTION OF INSTALLATION AT THE LAKE SHORE PLANT OF THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

Four twin boiler units are being equipped for pulverized-fuel operation. Each unit consists of two class P-13 Stirling boilers fifty-five tubes wide, having a heating surface of 30,600 sq.ft. and operating at 250 lb. gage with 250 deg. superheat. B. & W. superheaters and twin Foster economizers are used.

The furnace depth is about 20 ft., the height 21 ft. and the flame length about 60 ft. The total installation of boiler unit and pulverized-fuel equipment occupies a section 114 ft. high and 104 ft. deep, of which the fuel-preparing plant is 114 ft. high and 57 ft. deep. The common combustion chamber for the two boiler sections is 32 ft. wide at the base, contracting to 18 ft. at the throat, and about 52 ft. is the height from bottom to top of boiler.

Crushers reduce the coal to about ¾-in. size, and it then goes to a Green coal bunker in the boiler room, from which it drops to the pulverizing mill in the basement. From the mill the fuel goes to the top of the boiler room, where fans and separators are installed, and thence by screw conveyors to the two bins which supply each boiler unit. The boilers are fired from each side of the common combustion chamber. The arrangement for this plant is particularly good as regards the location of the equipment.

were found necessary if slagging was to be prevented. Dirty coal gave trouble until washed and much experimentation was done on burners.

With the furnaces used, 2,400 deg. is the average operating temperature at the bridge wall. Higher temperatures injure the lining, fuse the ashes and cause bad slagging. The burners have a flattened nozzle, which spreads the fuel in a horizontal fan shape, and one burner gives best operation on a 400-hp. boiler.

The Lakeside station of the Milwaukee Electric Railway & Light Company has a reported efficiency of boiler economizer and superheater of 88 per cent under steaming conditions of 265 lb. and 170 deg. superheat at 150 per cent rating. The boilers have 13,057 sq.ft. of heating surface with a combustion space of 9.057 cu.ft. The gases enter the economizer at 436 deg. and leave at 240 deg. The CO_2 leaving the economizer averages 12 bottoms, and air is drawn through ducts therein by the fans supplying the feeders. Test results are shown in the accompanying table. A complete description is given in the ELECTRICAL WORLD, page 721, April 15, 1922.

Features of other stations are pointed out in Figs. 5, 6, 7, 8 and 9.

In addition to these stations, several others in process of construction will use pulverized fuel, but their design plans are not yet completed.

CONCLUSIONS

There may be a present tendency to overdo the installation of pulverized-fuel equipment, when the limitations of available data and available apparatus are taken into consideration; but another year should see a sufficient number of new and large installations in service

to afford more reliable data and correct answers to some of the present questions and also to give positive evidence as to the adequacy of the existing equipment for very large stations operating at high ratings. In the contemplated plants those in charge state that only some details of the mechanical features are questioned and that no great difficulty is to be expected in improving them when the plants start operation. Thus each new installation is a specific case and must be so treated by the engineers, and it would be incorrect to generalize at present from the existing experiences of

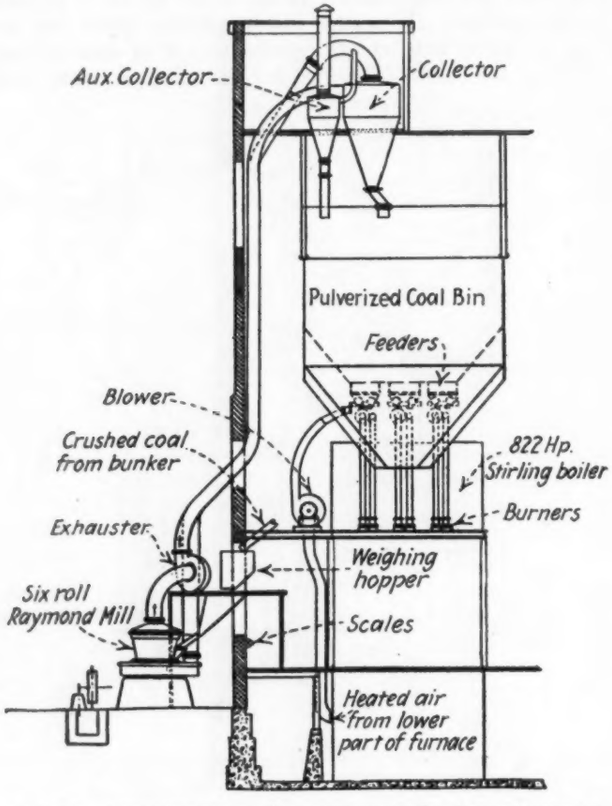


FIG. 10—ARRANGEMENT OF PULVERIZED-FUEL EQUIPMENT AT BRUNOT'S ISLAND PLANT

This experimental installation consists of a Class M-30 Stirling having 8,230 sq.ft. of heating surface, with a furnace 14 ft. 6 in. wide at the top and converging to 10 ft. in width at the bottom. Air-cooled side walls are used and secondary air is admitted through the front wall. Lopulco screw feeders take the coal from bins to the fan-tail burners, which are supplied with air from the side-wall air ducts by a motor-driven fan. Individual motors serve each of the three pairs of burners.

The furnace volume is 3,700 cu.ft., the height of the combustion chamber is about 36 ft. and the depth 15 ft., giving a flame length of about 45 ft. Water screens are used in the bottom of the chamber. The total height of the boiler installation is about 46 ft. and the depth 31 ft.

The pulverizer is a six-roll Raymond mill and delivers the coal by means of an exhauster to the overhead collector system. Driers are not used and the coal has a superficial moisture content of about 4 per cent with 2 per cent sulphur.

The experience with the installation has been very satisfactory, and curves ((Fig. 4) give test data on the plant. About 21 kw.-hr. per ton of coal pulverized is used by the installation. The experience with this installation has led to the adoption of pulverized fuel for the Colfax station.

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any one company. But many very successful plants are in operation which show that pulverized-fuel burning is displaying its inherent possibilities for efficient utilization under boilers, and the introduction of this new type of fuel has stimulated interest in and the development of all types and kinds of combustion equipment. Pulverized-fuel burning is here to stay and adds a new tool for producing electrical energy efficiently and economically.

Detailed Estimate of the Cost of Davis Bridge Development

Engineering Studies of Initial Installation of 32,000 Kva. Indicate Probable Over-All Expenditure of Nearly $9,000,000

ONE of the largest hydro-electric plants in the East is the Davis Bridge (Vt.) installation of the New England Power Company, situated on the upper Deerfield River a short distance above the Massachusetts-Vermont boundary. When completed, this station will exceed in capacity the combined Deerfield River plants at present in operation and will turn the flow of this stream into a virtually uniform volume. A comprehensive description of this project was published in the ELECTRICAL WORLD for June 16, 1923, page 1410. In connection with a recent petition to the Massachusetts Department of Public Utilities for authorization of a security issue, the company filed with the board one of the most detailed estimates of cost thus far presented to the commission in relation to a hydro-electric outlay, and this estimate is given here. To June 30, 1923, the company had expended about $4,350,000 of the estimated total of $8,816,903, and it is expected that the installation will be in operation in time to conserve the spring flow of 1924.

For an illustrated description of the Davis Bridge development the reader is referred to the article already mentioned, but, in order to enable the estimate to be more clearly visualized, the following résumé of the more important physical features of the development is presented:

The capacity of the present Deerfield River plants is 43,000 kw., that of the Davis Bridge development being 45,000 kw. The present yearly output of the Deerfield plants in operation is 144,000,000 kw.-hr., and the Davis Bridge development will effect a net increase of 136,000,000 kw.-hr. per year. The development includes the construction of a new reservoir of about 3.5 square miles area, having a capacity of 5,000,000,000 cu.ft. The mean operating head will be about 350 ft. and the reservoir will be about 10 miles long. The development involves the relocation of about 10 miles of the Hoosac Tunnel & Wilmington Railroad.

The dam will be 216 ft. high from the bottom of the cut-off trench, or 200 ft. above the original river bed. The maximum width up and down stream is 1,200 ft., this being the length along the top of the crest. The dam will contain 1,900,000 cu.yd. of earthfill.

A bypass tunnel handles the river flow during construction. This tunnel extends through the hill side on the east side of the river and is 22.5 ft. in diameter and about 1,500 ft. long. It is lined throughout with concrete of a minimum thickness of 2 ft. through the earth section at the upper end and a minimum thickness of 18 in. through the concrete section for the remainder of the tunnel. The tunnel is designed to carry a flood flow of 20,000 cu.ft. per second.

A circular type of spillway structure 160 ft. in diameter is provided, discharging into a vertical shaft 180 ft. deep and 22.5 ft. in diameter. The lower end of this shaft connects with the bypass tunnel, and the excavation for this spillway required the removal of 30,000 cu.ft. of ledge.

The flow of water through the power tunnel will be

controlled by an intake tower erected about 300 ft. upstream from the dam. This tower will be 125 ft. high and about 20 ft. in diameter, equipped with two valves in the base to control the flow of water. The power tunnel is to be 13,000 ft. long and 14 ft. in diameter, running in rock throughout. It will be lined with a minimum thickness of 6 in. of concrete. Near the tunnel outlet will be a plate steel surge tank 34 ft. in diameter and 184 ft. high. Plate steel penstocks 9 ft. in diameter will extend from the surge tank about 600 ft. down to the power house.

PLANT BUILDING SUFFICIENT FOR THREE UNITS

The power-plant building, 60 ft. x 110 ft. in plan, has a substructure of concrete built on ledge and a superstructure of brick and steel construction. The building is erected for three generating units, two of which are being installed at present. These units are of 19,500 hp. each, and each has a 16,000-kva. generator. Each wheel is controlled by a butterfly valve at the inlet in addition to a butterfly valve at the top of the penstock. The power-plant building incloses a low-tension bus structure, low-tension switches, switchboard, machine shop and office aside from the main generating floor. Erection is being handled by a 60-ton electrically operated crane also arranged to handle future repair work on the units and an installation of 110,000-volt transformers. It is planned to equip the generators for automatic synchronizing in view of the success of the automatic hydro-electric generating plant of the company lately completed at Searsburg, Vt. The 110,000-volt bus structure, with necessary switches, transformers and other equipment, is upstream from the power plant and about 100 ft. distant. The 60,000-volt bus and switches are similarly located downstream from the power plant.

ESTIMATE OF COST, DAVIS BRIDGE DEVELOPMENT

A—Local General	
Administration:	
Field superintendence—salaries and expenses	$45,000.00
Field office—salaries and expenses	40,700.00
Worcester office personnel in the field	15,200.00
Consulting engineers—services and expenses	2,000.00
Legal and right-of-way	15,300.00
Field engineering:	
Dam and appurtenances—salaries	49,500.00
Long tunnel and power house—salaries	35,240.00
Railroad relocation—salaries	24,780.00
Travel, hotel, automobiles and miscellaneous expenses	9,080.00
Camp buildings and equipment:	
Building	37,000.00
Equipment	18,650.00
Plumbing, sewer and water lines	11,350.00
Camp operation	4,000.00
Taxes, boiler and fire insurance	12,515.00
Liability insurance, premiums and hospital expense	16,000.00
Watching, lighting and guarding	8,500.00
Total, local general	$344,915.00
B—Construction Plant	
First cost	$40,000.00
Salvage value	* 25,000.00
Rentals	
Installation	6,000.00
Removal and storage	3,000.00
Maintenance and operation	20,000.00
Small tools	6,000.00
Total, construction plant	$50,000.00
Preliminary	
Investigations:	
Surveys	$46,376.94
Test pits	4,932.19
Borings	20,765.98
Lower power-house investigation	10,000.00
Clearing:	
Dam site, borrows and power house	5,808.70
Reservoir basin	35,000.00
Lumber operations	
Construction roads and bridges	13,000.00
Construction railroads and sidings:	
At dam	42,000.00
At power house	7,000.00
Highway changes	112,000.00
Relocation of Hoosac Tunnel & Wilmington Railroad:	
Acquisition of property—damage consideration	285,000.00
Switchback (1922)	41,500.00
Relocation of railroad—	
Local general	29,000.00
Plant	59,000.00
Preliminary	5,500.00
Grading	142,000.00
Trackage	104,000.00
Culverts, bridges and trestles	49,416.19
Freight and passenger depots, etc.	20,000.00
Removal of old line	*5,000.00
Transmission and telephone line changes:	
At dam and power house	6,625.00
Heath telephone line	10,375.00
Cemetery removal	4,500.00
Total, preliminary	$1,048,800.00
D—Dam	
Core-trench excavation	$67,500.00
Earthfill	1,254,000.00
Temporary diversion crib	$3,000.00
Miscellaneous	50,500.00
Total, dam	$1,375,000.00
E—Diversion Tunnel	
Construction of tunnel—contract	$404,250.00
Extra work on tunnel—outside contract	45,750.00
Total, diversion tunnel	$450,000.00
F—Spillway	
Earth excavation, rock excavation, and rockfill	$152,060.00
Concrete	127,260.00
Flashboards, control and spillway bridge	12,900.00
Tunnel closure and miscellaneous	36,980.00
Total, spillway	$329,200.00
FF—Penstock Excavation Cancellation	
Due to change in plans, necessitating cancellation of contract	$19,950.00
G—Gate House	
Earth excavation, rock excavation and backfill	$120,300.00
H—Pressure Tunnel	
Driving, trimming, concreting tunnel	$1,287,850.00
Special steel tunnel lining	18,304.00
Miscellaneous	3,846.00
Total, pressure tunnel	$1,310,000.00
J—Surge Tank and Tunnel Outlet	
Rock excavation	$21,000.00
Concrete	9,400.00
Steel tank	54,400.00
Steel-tunnel connection	6,600.00
Steel-tank connection	6,000.00
Steel breeching	15,500.00
Gates and flanges	27,000.00
Relief valves	3,000.00
Housing	25,000.00
Miscellaneous	13,100.00
Total, surge tank	$181,000.00
K—Penstocks	
Earth and rock excavation—concrete anchors, sills and reinforcing steel	$45,900.00
Backfill and steel railroad bridge	9,000.00
Penstock steel	55,600.00
Specials—Elbows, reducers, nozzles, manholes, flares, piping and miscellaneous	16,500.00
Total, penstocks	$127,000.00
L—Power House and Equipment	
Substructure—Excavation, foundations, concrete and reinforcing steel	$77,620.00
Auxiliary equipment in substructure—	
Air compressor, sump pump, miscellaneous, steel, etc	15,380.00
Superstructure—	
Brick building	86,000.00
Structural steel	24,000.00
Elevator, miscellaneous steel, etc	5,000.00
Machine-shop equipment	9,000.00
Crane	12,000.00
Inlet gates and accessories	24,000.00
Hydraulic equipment—	
Two 19,500-hp. hydraulic turbines and governors, with venturi, control panels, etc., unloaded and erected	$100,000.00
Electrical equipment (power house)—	
Two 16,000-kva., 360-r.p.m., 6,600-volt generators with exciters, together with motor-generator set (135-hp., 1,200-r.p.m., 2,300-volt motor and 90-kw., 1,200-r.p.m., 250-volt shunt-wound generator); main and auxiliary bus structures and equipment, with necessary power conduit and wiring; station-lighting apparatus, oil and water piping, telephones and equipment, operators' equipment and miscellaneous	270,660.00
Substations, outdoor—	
110,000-volt equipment—transformers, oil switches, arresters, etc., steel bus structures, high-tension wiring, etc.; 66,000-volt equipment—bus structures, oil switches, etc., control wiring, conduits, etc	317,900.00
Siding to power house	12,810.00
Road to power house	7,190.00
Testing and starting	6,400.00
Grading and cleaning up	4,040.00
Total, power house and equipment	$972,000.00
M—Tailrace	
Excavation	$18,900.00
Riprap	3,100.00
Total, tailrace	$22,000.00
N—Transmission Lines and Contractors' Transformer	
Equipment at dam and power-house sites	$85,000.00
O—Operators' Quarters	
Six cottages, bachelor quarters, garage, storehouse, water supply, plumbing and sewer and grading	$45,360.00
Lands, flowage properties, right-of-way roads, farms, etc.—Necessary lands for additional flowage area on account of erection of so-called high dam, from elevation 1,385 to 1,400 around the entire basin, aggregating 400 acres, including the right to flood the paper and pulp mill properties at Mountain Mills, Vt.; land to be used for borrow pits; tunnel right-of-way for a distance of 12,500 ft. along the pressure-tunnel line; also the necessary acquisition of properties situated in the basin area to be flooded, together with lands acquired to close highways in and about the basin	$583,700.00
Surety bond premiums, commissions, etc., on account of guaranteeing fulfillment of various contracts, etc	66,900.00
Interest during construction, being interest on moneys expended for construction from the commencement of the work until the development is placed in operation	681,300.00
Contractors' expense (10 per cent) and engineering expense, 5 per cent	1,004,478.00
Estimated total cost of Davis Bridge development	$8,816,903.00

*Credited.

Installation of Aerial Cables

Methods of Placing Cable in Position—Construction Equipment Used—Special Installation for Corners, Dead-Ends and Crossings—Protection of Cable and Provision for Future Extensions

By F. A. WESTBROOK
Formerly Field Engineer Habirshaw Electric Cable Company

THE methods of placing high-tension insulated aerial power cables on poles and holding them securely are naturally very much on the minds of engineers who are considering the use of this means of transmission and distribution. Although the practice is not a new one, it has, except in the case of a very few central-station companies, been employed for power work only here and there under special conditions. Now, however, more and more cases are arising where it is good engineering to use this type of construction, so that the methods employed by those companies which have already had experience in this direction furnish something definite to go by.

The Westchester Lighting Company is one of those which have installed a good deal of aerial cable in the past, and it is now doing a great deal more work of this kind. In this case it is interesting to note that one of the principal reasons for replacing open-wire circuits with cables, in addition to shade-tree and similar difficulties, is the greater freedom of cables from interruptions of service due to lightning storms. This has been demonstrated by experience.

The earlier cables used by the Westchester Lighting Company were of the varnished-cambric, steel-tape-armored type, but now this company is using paper-insulated, lead-sheathed cables, partly because of their superior electrical qualities and lower cost, but mainly because they can be taken down and installed in underground conduit in case such procedure should become advisable in the future.

STANDARD INSTALLATION USED

The aerial cables now placed are mostly three-conductor, 350,000-circ.mil, insulated for 13,200-volt transmission and protected with a lead-antimony sheath $\frac{1}{8}$ in. thick.

The messenger cable, consisting of 22,500 lb. galvanized-steel strand, is attached to poles by means of three-bolt clamps with studs passing through the center holes. When there are two cables, one on each side of the pole, a clamp is attached to each end of the through bolts. The poles are spaced about 100 ft. apart.

Blackburn galvanized-wire rings are used because they provide three points of support, which is desirable on account of the weight of the cables. The rings are spaced on 14-in. centers, but as they are 4 in. wide there is actually only a space of 10 in. from one end of a ring to the next. The grip of the rings, when properly placed on the messenger, is so tight that only an insignificant amount of slipping occurs while the cable is being pulled into place. Fig. 1 shows the two types of boatswain's chairs used for placing the rings. The end of the cable was prepared for pulling by sweating on a pulling eye placed over the conductors and wiping it to the lead sheath so as to prevent the entrance of moisture.

The cable was shipped on reels containing about 600

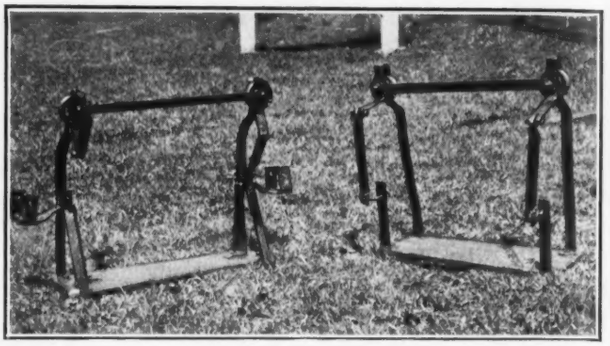


FIG. 1—TWO TYPES OF BOATSWAIN'S CHAIRS FOR PLACING CABLE RINGS

The steel support opens so that the runners can be placed over the messenger. The pulling rope is operated by means of a winch on a motor truck.

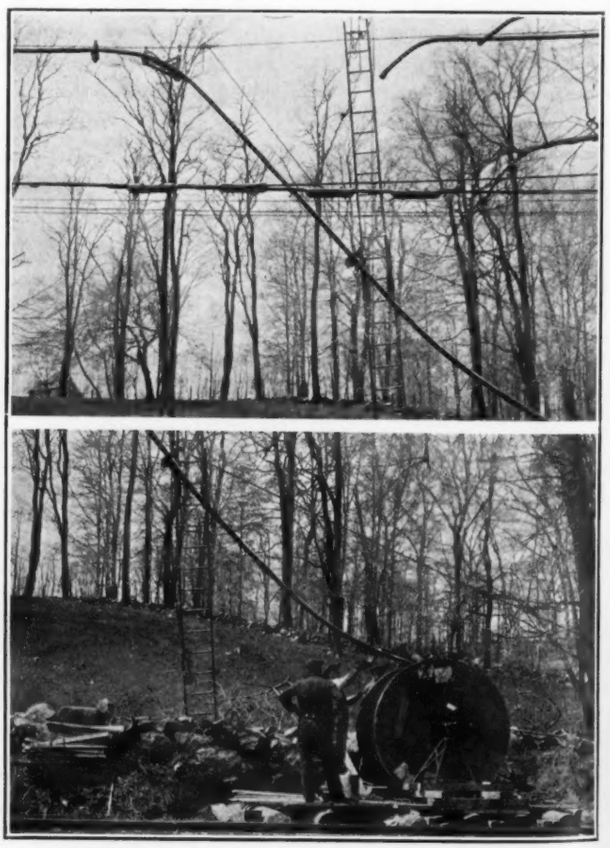
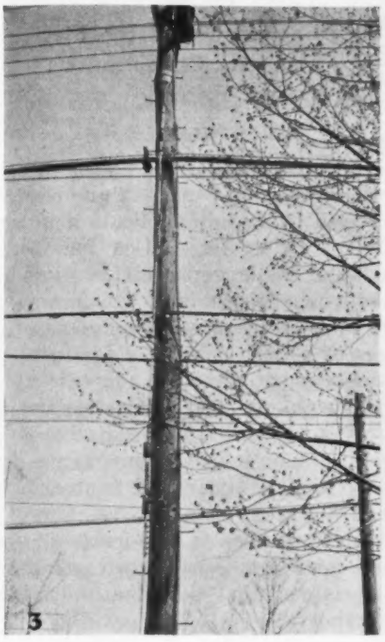
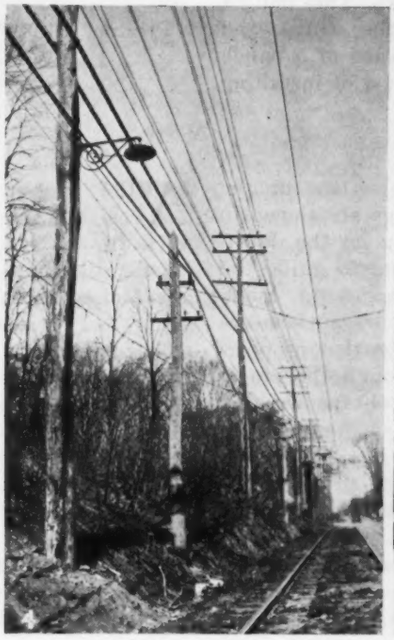
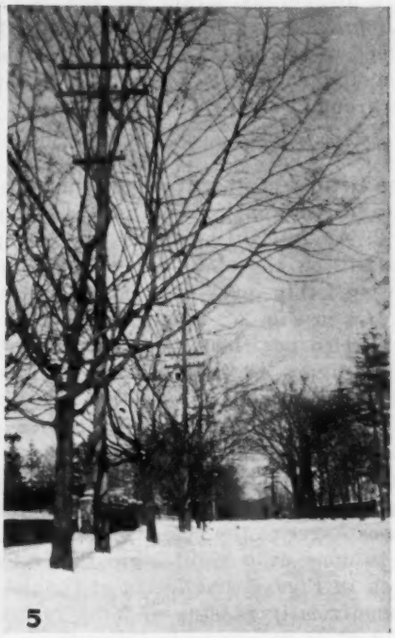


FIG. 2—CABLE IN PROCESS OF BEING PULLED

This shows how the cable is guided into the rings. The sheath is kept just as carefully greased as if it were going into conduit. Note the heavy rubber ducts which have been placed around the trolley feeders, carried on separate poles, to prevent injury to workmen and cables. A 4-ton cable reel trailer is now generally used in place of the temporary platform and jacks. This has been found much easier to use and affords a cheaper and faster method for handling the cable reels during the installation period.







Typical Installations of Aerial Cables

Fig. 3—Cables are supported at each pole temporarily by means of rollers clamped to the messenger.

Fig. 4—Two parallel cables in place. The two upper cross-arms will be removed and the lower arm left for local distribution.

Fig. 5—Aërial cable installation on residential street where open wiring would be impracticable.

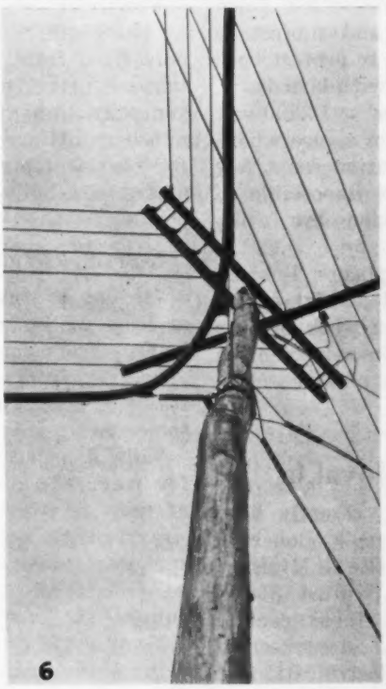
Fig. 6—At a right-angled turn the rings are reinforced by wrappings of marline and the messenger by an extra piece of steel strand passing around the pole.

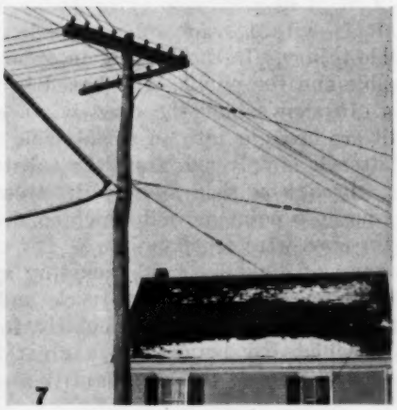
Fig. 7—An important feature of guying on right-angle turns is to get the guys close to the messenger so that the pull of the cable will be taken by the guys instead of by the pole.

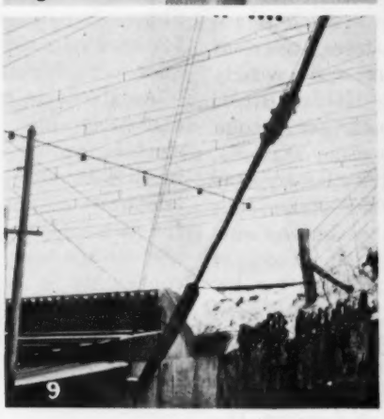
Fig. 8 — Dead-end guying where aërial cable joins the underground system.

Fig. 9—Passing under a low railroad bridge, the cable is boarded.

Fig. 10—Open wires entering aërial cable at 13,200 volts. Note line guys used to compensate for the greater weight of the cable. Compression-chamber arresters adjacent to the cable terminal pole have given good service.







ft., which was a convenient length to pull without putting a dangerous strain on the poles. The pulling rope, previously threaded through the rings and attached to the cable, is operated by means of a winch on a motor truck just exactly as in the case of installing underground cable.

PULLING THE CABLES

The details of the arrangements for setting up the reels and guiding the cable into the rings are shown in Fig. 2. An interesting detail for taking up the downward pull on the rings at the poles and to guide the cable smoothly over and around changes in angle is shown in Fig. 3. When preliminary precautions are well carried out there is no visible vibration of poles or messengers as the cable travels through the rings. It is altogether improbable that the steel-tape-armored type of cable could be installed with such ease, even if it could be pulled through rings at all.

Another very important feature of aerial cable construction is the matter of guying the line and attaching the messenger to the pole at dead-ends and turns. How this is done at a right-angle turn at a street corner is seen in Figs. 6 and 7, and at the dead-end in Fig. 8.

Sometimes in passing under a railway bridge, as in Fig. 9, it is necessary to bring the cable so low down that it is within reach of passers-by and subject to possible injury. In these cases, in order to protect both the cable and the public, it is boxed in with boards.

Fig. 10 shows how the open wires of a 13,200-volt circuit are brought into an aerial cable in a case where the latter is simply run from the substation for a few miles, through a road lined with trees impossible to trim, out to a point beyond which conditions are favorable for open-wire construction.

A gang of eighteen men, including splicers, linemen and helpers with their own truck and special equipment, has been trained particularly for work of this nature, which has resulted in a great improvement in efficiency in respect to both quantity and quality.

Water Powers of Czechoslovakia

FIVE new water-power stations have recently been completed or are nearing completion in Bohemia, according to reports issued by the Czechoslovak Ministry of Public Works and summarized by United States Consul Winans. The construction of these central hydro-electric plants was begun last year in connection with the government's plans for the electrification of this section of the republic. The power stations reported ready for operation are on the Jizera River, at Spalov, with a flow of 12 cu.m. per second and a yearly output of 11,000,000 kw.-hr., and on the Moldan River, near Latostice, with a flow of 9.48 cu.m. per second and an output of 6,900,000 kw.-hr. The other stations, in course of construction, are on the Zelivka River, near Humpolic, with an estimated output of 6,000,000 kw.-hr.; on the Cerna River, at Kaplice, with an estimated output of 5,600,000 kw.-hr., and on the Mze River, at Blahoust, with an estimated output of 1,700,000 kw.-hr. In addition to these projects, plans are being prepared for better utilization of the water powers of the Vydra, Kremelna and Sazava Rivers, and the government is considering schemes for the electrification of Russinia, which will include the construction of a dam on the River Uz.

Pertinent Facts About Mica*

Product Finds Its Principal Use in the Electrical Industry—Specifications, Classifications and Average Prices

BY OLIVER BOWLES
Mineral Technologist, United States Bureau of Mines

ABILITY to withstand heat and high electrical resistance have led to a wide application of sheet mica in the electrical industries. Mica has become so essential that some of the larger electrical companies own and operate their own mica mines, which, however, supply only a part of their requirements. One of the most important uses of electrical mica is for insulation between commutator segments, and its adaptability for such a purpose depends chiefly on its dielectric strength —that is, its ability to resist disruptive discharge due to difference in potential between the segments on either side of it. Only high-grade mica, free from iron impurities, pinholes or cracks, can be used for this purpose. A soft variety of mica is preferable, in order that the copper and mica may wear down evenly, and in this respect it is claimed that Canadian amber mica is superior to all others.

Practically all marketable mica is of the muscovite or phlogopite type. Biotite and chlorite are sold in pulverized form, but the amount thus used is so small that no further mention of it need be made. Mica falls generally into three classes—sheet mica, including punch; splittings, and scrap. Sheet mica is used chiefly for electrical purposes and for glazing; splittings are made into built-up mica, and scrap is ground to a powder.

SPECIFICATIONS OF MICA FOR ELECTRICAL USES

Mica to be classed as sheet must yield a rectangle of at least 1½ in. x 2 in., must split evenly and freely, be free from cracks, rulings or plications, and reasonably free from inclusions of foreign matter, though stains of a non-conducting character are permissible for some uses.

Thin films are used in vast numbers in condensers for magnetos and wireless apparatus. A high quality of mica is demanded for condenser use. It must be clear ruby, colorless or greenish, must split easily into smooth plates one-thousandth of an inch thick, and must be free from cracks, holes, stains, spots, wrinkles, rulings, air bubbles or knots in any form. Large sizes are not usually required, 1½-in. x 2-in. or 2-in. x 3-in. being those ordinarily used. For wireless outfits each film must be capable of withstanding 20,000 volts, while for magneto condensers a much lower electrical resistance is permissible.

As sheets in greatly diversified shapes, or as washers and tubes, mica is used extensively as an insulator in electric machines and in various fittings or appliances, in fuse boxes, insulators, electric heaters, flatirons and telephones. The highest grades of mica are required for condensers and spark plugs, but for uses where low-voltage currents are employed less perfect mica containing a limited amount of impurities may be employed.

Mica splittings consist of thin flakes split from the smaller sheets or from waste fragments. They are usually not less than 1 sq.in. in area, of irregular shape

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TABLE I—PERCENTAGES OF GROUND MICA USED IN VARIOUS APPLICATIONS

Patent roofing	60
Wall paper	21
Automobile tires	8
Fancy paints, concrete facing, Christmas tree "snow"	3
Molded electric insulation	3
Annealing, filling in rubber other than tires, printing, lithography and sizing cotton	3
Lubrication	2

and not more than one one-thousandth of an inch in thickness. They are used for the manufacture of built-up mica, consisting of the thin plates stuck together with shellac. Built-up mica is used chiefly for commutator segments and in various forms in generators, motors and transformers.

The invention of built-up mica marks one of the most important developments in the industry. Many hundred tons of splittings are used every year in making products that are quite satisfactory for many electrical purposes, thus filling a demand which it would be impossible for the world to supply with sheet mica at the present rate of production. The chief industries using sheet mica and splittings are manufacturers of electrical equipment, stoves, phonographs, lamp shades and chimneys. Ground mica is used by manufacturers of composition roofing, rubber products, wall paper and lubricants.

Consumption of Mica by Countries

There is little recovery of mica once used, and consquently consumption on an average is practically equivalent to production. No recent figures are available concerning consumption of mica by countries, but prior to 1914 the world consumption of sheet mica was estimated to be about 3,500 short tons per annum. The percentage consumed by each country was approximately as follows: United States, 49; Germany, 23; Great Britain, 11; India, 11; France, 3; Italy, 1½, and all other countries 1½. During recent years United States production has varied from 275 tons to 1,200 tons per year. Of sheet mica, not including punch, the United States produced in 1921 only about 20 per cent of its requirements, and consequently large quantities are imported.

The United States classification for mica is as follows: The lowest grade of sheet mica is designated as "punch." The uncut sheet must be of sufficient size to yield a circle 1½ in. in diameter if stained and 1¼ in. if clear. The next-size circle should provide a disk nearly 2 in. in diameter. The sizes of rectangular sheets vary from 1½ in. x 2 in. to 8 in. x 10 in. and larger, the exact sizes being those shown in the accompanying table giving the average prices of mica per pound paid at mine. When properly trimmed the uncut mica sheet is approximately one and one-half to two times as large as the maximum standard rectangle that may be cut from it. Each class includes the size designated and all larger sizes until the next class is reached. Thus, a sheet that would cut to a rectangle 3½ in. x 5½ in. or 3½ in. x 6 in. would be classed as 3 in. x 5 in.

TABLE II—AVERAGE PRICES PER POUND PAID AT MINES IN SOUTH FOR ROUGH-TRIMMED SHEET MICA OF GOOD QUALITY, SPLIT AND SORTED TO CUT TO SIZES INDICATED

Sizes (In Inches)	1915	1916	1917	1918	1919	1920	1921	1922*
Punch	$0.04	$0.05	$0.055	$0.07	$0.08	$0.10	$0.06	....
1½ x 2	0.20	0.30	0.40	0.55	0.55	0.51	0.35	$0.20
2 x 2	0.40	0.55	0.70	0.90	0.95	0.84	0.55	0.45
2 x 3	0.70	0.90	1.10	1.30	1.35	1.25	1.00	0.80
3 x 3	1.00	1.35	1.55	1.75	1.85	2.04	1.40	1.30
3 x 4	1.25	1.79	1.85	2.05	2.15	2.37	2.00	1.70
3 x 5	1.50	1.95	2.15	2.45	2.55	2.95	2.50	2.25
4 x 6	2.10	2.85	3.10	3.45	3.50	3.85	3.00	3.00
6 x 6	2.80	3.50	3.80	3.90	....	4.00	3.50	4.50
6 x 8	3.50	5.00	4.70	6.00	....	5.00	5.00	4.50
8 x 10	5.20	7.50	7.50	8.00	....	7.00	....	....

*Domestic mica, No. 1 quality, quoted in October, 1922, f.o.b. North Carolina.

Requirements of mica for electrical purposes relate to dielectric strength, heat resistance and flexibility. All good mica is sufficiently resistant to heat for ordinary electrical equipment, and this quality is therefore rarely specified. Specifications for dielectric strength vary for different uses and with different consumers for similar uses. Navy Department specifications call for a dielectric strength not less than 25,000 volts for each $\frac{1}{64}$ in. in thickness. Mica has such a high dielectric strength that failures most commonly occur in defective spots. It is very important therefore in selecting material where high dielectric strength is required that the mica shall have a careful visual examination so that all defective sheets may be rejected. A still better method is to pass over the surface a high-tension terminal of a vibrator-type ignition coil.

The pound is the unit on which the price of all mica is based, except finished condenser, diaphragm and radio sheets, which are sold by the thousand. The value is computed on the basis of quality and size of sheets, but prices vary considerably, as they are usually determined by individual bargaining rather than by fixed quotations. The abundance or shortage of any particular size has an important influence on the price paid.

As regards stability of prices, it may be noted that the sheet-mica industry is governed largely by activity in the electrical field. The price ordinarily paid for clear sheet mica is indicated in one of the accompanying tables, compiled by the United States Geological Survey. Grinding mica during the past year was quoted at $23 per ton delivered at a New Hampshire mill. The prices listed represent average conditions, but prices vary greatly for individual sales. The highest-priced foreign micas are those from India, South Africa, Brazil and Canada.

Mica is handled either by dealers who simply buy and sell or by manufacturers who work it up into finished forms that are sold to electrical companies or other consumers. Practically no mica passes directly from the producer to the consumer, though, as noted above, some of the larger electrical companies operate their own mines. The marketing of mica is so complex that the office of the intermediary concerns seems to be a necessity.

It is very important that every producer should know the dielectric strength of his product, the nature and detrimental effects of impurities or other defects, the sizes that are most in demand and standard classification by quality. Lack of knowledge and consequent lack of proper preparation of mine-run mica has tended to discourage development of domestic deposits, for, through poor classification and trimming, together with insufficient information on values, the producer is commonly forced to accept prices so low that active enterprise is discouraged.

A better standardized classification by quality would tend to protect the producer against degradation of his product, an element that greatly discourages domestic production. This practice may be due in part to poor preparation of the material offered for sale, but it is commonly due to looseness in classification, a loophole that works to the disadvantage of the producer.

Cost of Money to Utilities

Analysis of the Relationship Between Capitalization and Dividends and Influence of Different Classes of Securities—Who Pays the Cost of Money and How that Cost May Be Reduced

By C. T. CHENERY

CERTAIN costs of producing and distributing electrical energy are subjected to the closest analysis, and the most painstaking and minute investigations are made to clip a fraction of a mill from them. The cost of fuel belongs in this class. The reduction of almost each single B.t.u. from the previous number required to generate a kilowatt of energy has been the subject of a separate triumph.

On the other hand, the cost of money is at least as important as the cost of fuel. It takes, on the average, 40 kw.-hr. of steam-generated energy to produce one dollar of revenue, and 15 cents would be a high estimate of the amount expended for fuel out of each dollar of gross thus received by an electric utility; but 30 cents would be a low estimate of the amount expended, in the form of bond and note interest, preferred and common stock dividends for the rent of money. Yet, with the exception of the various features of the customer-ownership movement, discussion of this most important cost is conspicuous by its absence.

The reason perhaps is not difficult to discover. The utility business has drawn its officers and managers largely from the ranks of the engineering profession. The improvement of mechanical processes, the elimination of waste in the conversion of other forms of energy into electrical energy, the development of new fields of usefulness—these are the problems that absorb us. They are tangible things and offer a definite resistance to be overcome and a definite financial reward for doing so.

The cost of money, however, has been grouped among certain intangible costs and considered as a problem more or less set apart for solution by the directors and bankers of the company. Yet this cost of money is just as susceptible of being varied as is the cost of fuel, and the saving possible to be effected amounts to many times the savings that are indicated by other lines of research.

WHO PAYS COST OF MONEY?

Under commission regulation it is not of major importance to the revenue of a utility company (except in so far as its ability to obtain new business is affected) whether a pound and a half or four pounds of coal is used under its boilers to generate a kilowatt of energy, for unless the plant is demonstrably inefficient or badly managed, the cost of this fuel is a proper item of operating expense and as such, under the cost-plus method of rate regulation, is passed on to the public. Under this plan there is neither incentive nor reward for economical operation nor is there a penalty for uneconomical operation. The amount of the return allowed to a company is dependent almost entirely on the value of its property and has little to do with the quality of its management.

In addition to actual or estimated operating expenses, however, the rate is made up of an allowance for the depreciation of the property and a return which is expressed as a percentage of the value of the property, or rate base. This rate of return is supposed to cover the cost to the utility of the money which it has invested in the public service.

Thus the utility is in theory reimbursed at cost for all other expenses than the cost to it of money, and this expense is covered by a lump-sum allowance and theoretically is the source of profit or loss.

If the company is able to obtain its money at less than the 7 or 8 per cent allowed as a rate of return by the commission, such saving is profit to the company. If, however, the money costs the utility more than the rate allowed it, such difference represents a loss to the company.

INFLUENCES ON COST

The importance of this cost being apparent, it remains to be seen to what extent it can be varied. Consider first the matter of capitalization, and to be specific examine the "X" company which is capitalized as follows:

First mortgage 6 per cent bonds	$5,000,000
Preferred stock*	.....
Common stock, 50,000 shares	5,000,000
Total capitalization	$10,000,000

*Five leading electric light and power companies have no preferred-stock issue.

The value of the company's property for rate-making purposes is $10,000,000. The company is permitted by the regulatory bodies to earn a return of 7½ per cent on the rate base in addition to (1) its operating expenses and (2) an allowance for depreciation.

The earnings available for common stock are as follows:

Net earnings, 7½ per cent on $10,000,000	$750,000
Deduct bond interest, 6 per cent on $5,000,000	300,000
Available for common stock	$450,000
Earnings per share of common stock (50,000 shares)	9 per cent

The capitalization above outlined is an excellent one from the viewpoint of strength, as the fixed charges of the company are very low and the capitalization is itself quite flexible in that it permits new securities of any desired class to be issued. It is not, however, the most advantageous capitalization from the standpoint of earnings on the common stock of the company.

It is almost an axiom, and can be verified by an inspection of almost any public utility quotation sheet, that the cost to utility companies of money obtained from various classes of security issues is least in the case of mortgage bonds. Then come collateral trust bonds, debenture bonds and preferred stock in the order named, and finally common stock, which is the most expensive of all.

It is also apparent that the fewer the shares of common stock which are issued, the fewer parts there will be into which to divide the final net earnings of the company and the higher will be the earnings for each share of common stock. As the common stockholder is the owner of the company, subject always to the priorities and preferences of ranking security holders, any action which increases the return to the common stockholder has the same effect as decreasing costs.

RESTRICTIONS ON SECURITIES

Let us examine the capitalization of the company, then, to see how we may vary its stocks and bonds to increase the earnings of the common stock holder.

As bonds represent the cheapest money securable, the first step is to determine the maximum amount of bonds issuable under the restrictions imposed by sound finance. The assumptions are made that further bonds may be issued at a cost to the company of 6 per cent and that 7½ per cent preferred stock may be sold at par.

The restrictions on the further issuance of bonds are two:

1. That the amount of the bond issue shall not exceed 75 per cent of the value of the property, or rate base.

2. That net earnings, exclusive of depreciation, shall amount to twice bond interest.

Restriction No. 1 limits the bond issue to 75 per cent of $10,000,000, which is $7,500,000.

Restriction No. 2, however, requires that net earnings, which are $750,000, shall be double the annual bond interest, thus limiting bond interest to $375,000. As the bonds bear interest at the rate of 6 per cent, the amount that may be issued under this restriction is $6,250,000.

The amount of the bond issue is therefore fixed at $6,250,000.

The restrictions governing the issue of preferred stock are:

3. There shall be an equity for each share of preferred stock of at least $150.

4. The preferred stock dividend shall be earned twice over.

In tabular form:

The value of the property is	$10,000,000
The bond issue is	6,250,000
The equity remaining for preferred stock is	$3,750,000
And the preferred stock issuable under Restriction No. 3 is	$2,500,000

Under Restriction No. 4 the preferred stock dividend must be earned twice.

The net earnings of the company are	$750,000
The bond interest is 6 per cent of $6,250,000	375,000
Earnings available for preferred and common stock	$375,000

The preferred-stock dividend of 7½ per cent must be earned twice. The amount of this dividend then cannot exceed one-half of $375,000, or $187,500. This limits the preferred stock issue to $2,500,000.

LOW COST RATIOS

The suggested capitalization then is as follows:

First mortgage 6 per cent bonds	$6,250,000
7½ per cent preferred stock	2,500,000
Common stock	1,250,000
Total	$10,000,000

The earnings for the common stock would be as follows:

Net earnings of company, exclusive of depreciation		$750,000
Bond interest, 6 per cent on $6,250,000	$375,000	
Preferred stock dividend, 7½ per cent on $2,500,000	187,500	
		562,500
Available for common stock (12,500 shares)		$197,500
Earnings per share		$15.80

Thus with the same net earnings it has been shown to be possible to increase the common stock dividends from the then earnings of 9 per cent to 15.8 per cent by merely changing the make-up of the company's capitalization.

It may be urged that the percentage of common stock herein set forth is too low for safety, and with that conclusion the writer has no quarrel. He has merely set it up as being the minimum permissible under the condition outlined.

Consider, however, the conservative capitalization of:

First mortgage bonds	$6,250,000
7½ per cent preferred stock	1,875,000
Common stock	1,875,000
Total	$10,000,000

Then the earnings available for common stock are as follows:

Net earnings of company		$750,000
Deduct bond interest, 6 per cent on $6,250,000	$375,000	
Preferred stock dividend, 7½ per cent on $1,875,000	140,625	
		515,625
Available for common stock (18,750 shares)		$235,375
Earnings per share		$12.56

Even on this basis the earnings on the common stock can be increased by more than a third, or from 9 per cent to 12.56 per cent.

A composite balanced sheet of fifteen important electric light and power companies shows the following:

Combined plant account	$1,169,436,270
Funded debt outstanding	$574,376,000
Preferred stock	122,276,000
Common stock	401,496,000
Capitalization	$1,098,148,000

or reduced to percentages: Funded debt, 52.3; preferred stock, 11.1; common stock, 36.6.

The result of operations of these fifteen companies for the year 1922 was as follows:

		Per Cent of Gross
Gross earnings	$232,713,619	...
Net earnings	100,635,806	43.2
Depreciation	19,653,619	8.5
Available for fixed charges	$80,982,187	...
Fixed charges	35,189,664	15.1
Available for dividends and surplus	$45,792,523	19.7
Preferred stock dividends	8,988,357	...
Available for common stock	$36,804,166	...
Common stock outstanding		$401,495,950
Earnings per share of common stock		9.16 per cent

Let there now be substituted for the present capitalization of these companies a new capitalization made up of funded debt, 60 per cent; preferred stock, 20 per cent, and common stock, 20 per cent, and use the same cost of money which the companies are now paying. At present the companies have a funded debt of $574,376,000, which costs them $35,189,664 yearly, equivalent to 6.126 per cent, and preferred stock, $122,276,000, which costs them $8,988,357 yearly, equivalent to 7.351 per cent. The suggested new capitalization then is

Funded debt, 60 per cent of $1,098,000	$658,889,000
Preferred stock, 20 per cent of $1,098,148,000	219,629,500
Common stock, 20 per cent of $1,098,148,000	219,629,500
Total	$1,098,148,000

The earnings for the common stock under the suggested capitalization would be as follows:

Net income available after depreciation	$80,982,187
Deduct funded debt interest, 6.126 per cent on $658,889,000	40,363,540
Available for dividends and surplus	$40,618,647
Deduct preferred stock dividends, 7.351 per cent on $219,629,500	16,144,965
Available for common stock	$24,473,682
Shares outstanding	2,196,295
Earnings per share	11.14 per cent

Again it appears to be possible to make a large increase in the return to the common stockholder by substituting a different capitalization. In the present case for the combined companies it seems to be practicable to raise the earnings of the common stockholders from 9.16 per cent to 11.14 per cent, an increase of 23.4 per cent. The new capitalization, while not so strong as the one it displaces, would certainly meet the tests which bankers normally apply.

This calculation is based on the assumption that the books of public utility companies correctly reflect the present fair value of their properties and that a valuation, for rate-making or security-issuing purposes, would establish values in harmony therewith. This assumption in times past might well have been considered unwarranted; however, the trend of recent Supreme Court decisions in valuation matters and the favorable outcome of the valuation of the steam railroads by the Interstate Commerce Commission would appear to justify it.

No Universal Formula for Determining Capitalization

The whole subject of capitalization and cost of money is one of the utmost importance to the utility companies and one which should return handsome rewards for work done. It will never be possible to reduce capitalization to a formula, for the problems involved call for individual solution; but it should be possible to point out certain definite limits and indicate some of the more obvious mistakes which have been made in the past.

That there is need for such work is evidenced by the commonly accepted belief that there are not ten holding or operating companies in the field with a sufficiently flexible financial structure and sufficient credit facilities to permit of the full expansion of their business as opportunities present themselves. Yet such flexibility is a fundamental requirement if better service is to be rendered.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Comparison of Plain-Break and Explosion-Chamber Breakers

To the Editors of the ELECTRICAL WORLD:

I have noted with interest the reprint of the paper presented before the South African Institute of Electrical Engineers in your issue of July 28. This article discussed the action of plain-break and explosion-chamber types of oil circuit breakers. Without entering into a theoretical discussion of the action which takes place in the breaker, it may be interesting and illuminating to show a few oscillograms and plots of observations

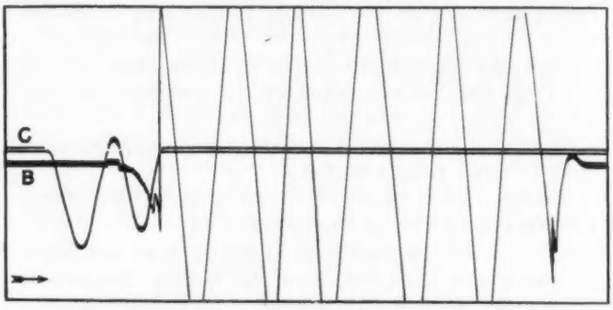
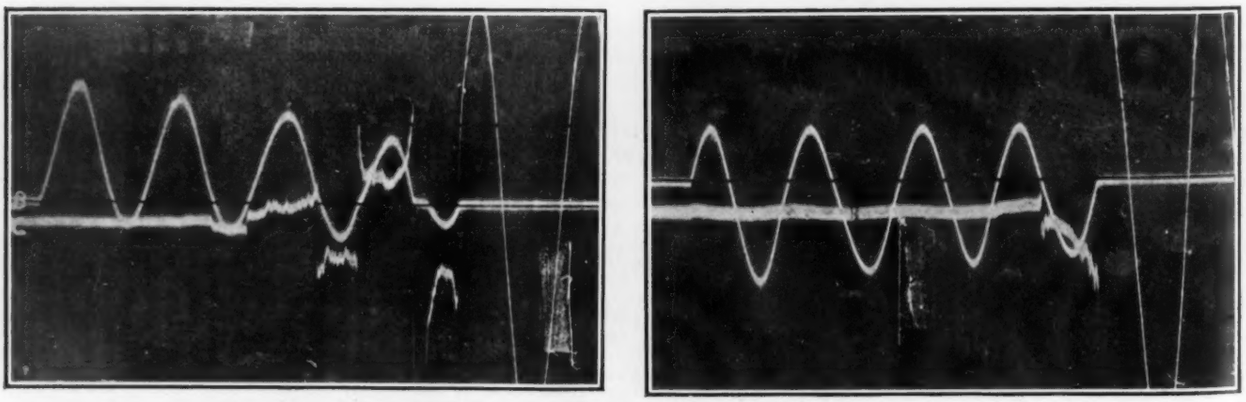


FIG. 1—EXPLOSION-CHAMBER BREAKER INTERRUPTING 10,000 AMP.

from actual tests made upon the two types of breakers with the large testing generator of the General Electric Company at its Schenectady plant.

Each series of tests was made in the same breaker structure, with the same operating mechanism, operating at as near the same no-load speed, current, voltage and circuit conditions as it was possible to obtain. The only difference was that in one case a plain break and in the companion case an explosion chamber was used. In short, the conditions under which the comparative tests were made were as nearly identical as it was possible to make them.

Comparison of the arc-rupturing abilities of a plain-break breaker and an explosion-chamber breaker interrupting approximately 5,000 amp. under the same conditions are afforded by Figs. 2 and 3. The arc



FIGS. 2 AND 3—PERFORMANCE OF PLAIN-BREAK AND EXPLOSION-CHAMBER BREAKERS INTERRUPTING 5,000 AMP. UNDER SIMILAR CONDITIONS

duration, namely, six half cycles for the plain break and two half cycles for the explosion chamber, indicate in a way the efficiencies of the two breakers. The current interrupted in the case of the plain-break breaker was all it could safely stand as determined by oil throw and bulging of the tank. Performance of the same explosion-chamber breaker, interrupting approximately 10,000 amp. under identical conditions with the 5,000-amp. test, is shown in Fig. 1. This duty was accomplished with signs of less distress than was manifest with 5,000 amp. and plain-break contacts. The superiority of the explosion-chamber construction is clearly shown by the tests to which allusion has just been made.

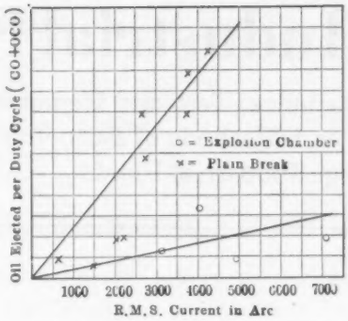


FIG. 4—OIL EJECTED PER DUTY CYCLE BY THE TWO TYPES OF BREAKERS

The speed characteristics of the plain-break and explosion-chamber breakers are illustrated by Fig. 5. These breakers are the same as those whose curves are shown in Figs. 2 and 3 and had the same no-load speed. The superiority of the explosion chamber is indicated by its increased speed acceleration with the increases of current interrupted.

The arc lengths in the plain-break and explosion-chamber breakers are indicated in Fig. 6. The plain-break breaker test was limited to the current value indicated because the arc frequently held to the end of the stroke at that value, while with the explosion chamber there was no such limitation and the circuit was always satisfactorily interrupted up to the limit of our generating capacity at the test voltage.

The quantity of oil ejected from one of the old-style breakers, which were not especially built to prevent oil throw, is an indication of the efficiency of the breaker's internal construction. Such a comparison is shown in Fig. 4. Here also the marked superiority of the explosion chamber over the plain-break construction is shown because the oil throw is an indication of the quantity of gas generated and, therefore, of the stress to which the oil tank is subjected.

In general, the conclusions arrived at by Mr. Price, as a result of his work in Africa, were demonstrated as facts some time ago by exhaustive tests made at Schenectady. Observations from the several thousand short circuits made have been plotted, and the deductions drawn are from the most severe results observed. This is important, as the severity of an *individual* interruption in a series of tests made under identical conditions may vary from no arc at the contact points to a severe explosion. It is only by making many tests that the most severe conditions obtainable can be observed, and it is this severe condition which must determine the absolutely safe interrupting capacity rating of a breaker.

J. D. HILLIARD,
General Electric Company, Switchboard Department.
Schenectady, N. Y.

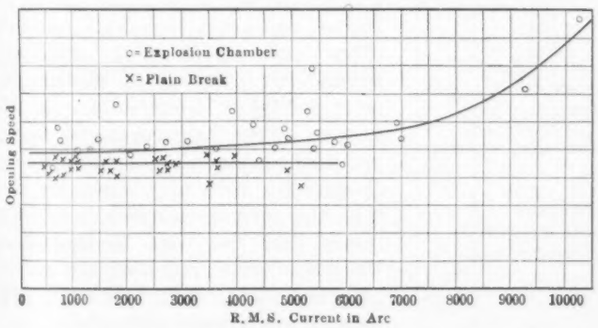


FIG. 5—SPEED CHARACTERISTICS OF PLAIN AND EXPLOSION-CHAMBER BREAKERS

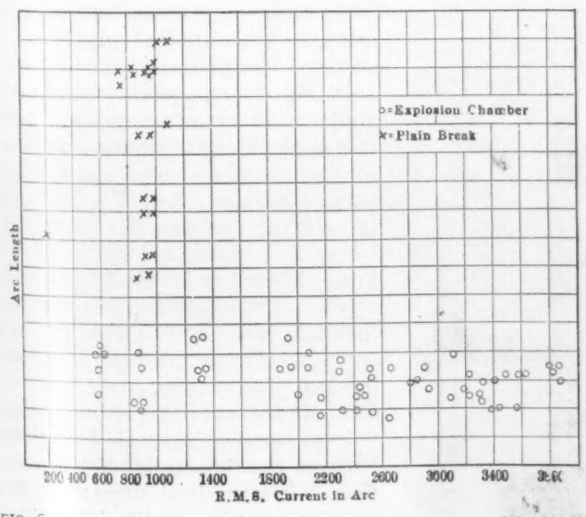


FIG. 6—ARC LENGTHS DRAWN IN THE TWO TYPES OF BREAKERS

Seeking Information on the Carrying Capacity of Conduit Circuits in Mines

To the Editors of the ELECTRICAL WORLD:

There are considerable available data on the heating of lead-covered cables, and the temperature of a wire in air can be figured with a reasonable degree of closeness. I have been unable, however, to find data on rubber-covered, double-braided conductors in conduit. For many installations a knowledge of the exact temperature limitations is very valuable, and yet I have been unable to find any reliable information on the subject.

Knowing the ambient temperature, I should like to be able to figure the temperature of the conductor and insulation, using the heat generated per unit length of wire as a basis. Naturally the conductors do not fill the conduit and therefore will lie on the bottom, which condition may be taken care of by mathematical means or by the introduction of experimental constants. The greatest question seems to me to be, What is the action of the body of air within the pipe? How much convection of heat exists?

I have been unable to conduct any tests personally, but the matter seems to be one for experimental determination. Figuring the body of air within the pipe as motionless gives results which are found entirely too high.

As a problem assume three No. 1/0 B. & S. gage rubber-covered, double-braided copper conductors, each carrying 200 amp. This means that when the temperature of the copper is constant 11.81 watts must be dissipated for each foot of length. With the conduit surrounded by air at 65 deg. F., what is the temperature of the copper?

B. K. SHANER.
Frackville, Pa.

Central Station and Industrial Practice

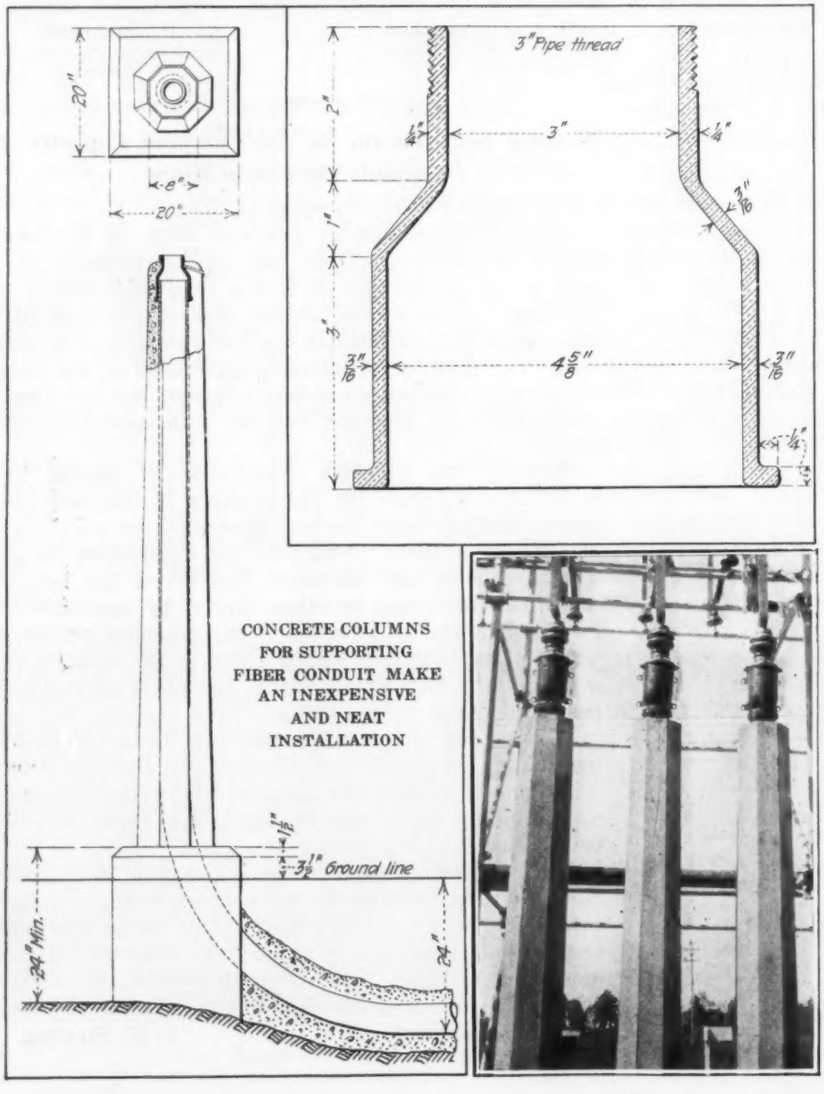
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Supporting Fiber Conduit and Potheads with Concrete Columns

BY C. E. SCHNELL
Designing Electrical Engineer San Joaquin Light & Power Corporation, Fresno, Cal.

CONCRETE columns were found to be the cheapest and most satisfactory support for the fiber conduit and cable potheads at the new California Avenue substation of the San Joaquin Light & Power Corporation at Fresno, Cal. Lead-covered 18,000-volt cables were used to carry the incoming and outgoing 12,000-volt circuits from the substation building to the outdoor bus and switching rack.

Iron conduit could not be used because some of the cable was 600,000 circ.mill single conductor, and accordingly fiber conduit was used for this as well as the three-conductor cable. The fiber conduit was cast in concrete columns as shown. A pothead flange was placed at the top of each column at the time of pouring the concrete. These were made of brass for the single-conductor cables and of cast iron for the three-conductor cables. On the top of each flange a standard 3-in. pipe thread was cut, and a ¾-in. pipe was threaded into the side and projected out through the concrete to ventilate the duct. Collapsible forms were used in pouring the thirty columns required. Actual installation of cables and potheads has shown this method of supporting fiber duct to be very satisfactory both as to cost and appearance.



CONCRETE COLUMNS FOR SUPPORTING FIBER CONDUIT MAKE AN INEXPENSIVE AND NEAT INSTALLATION

Accidental Grounds Located with Telephone Receiver

BY T. W. SNELL
General Superintendent Coast Valleys Gas & Electric Company, Salinas, Cal.

FOR locating accidental grounds on its secondary distribution system the Coast Valleys Gas & Electric Company uses an ordinary telephone receiver and telephone induction coil. Where local or state rules require the grounding of distribution transformer secondary neutrals, trouble is often experienced with accidental grounds which occur on the outside, or "hot legs" to ground. If the ground at the transformer is not in good shape, these accidental grounds frequently prove of lower resistance than the permanent ground, with the result that the wire leading down the transformer pole and the ground pipe or rod are raised to nearly 110 volts above ground potential.

If the induction coil is held at right angles and near to a wire carrying alternating current, a distinct humming is heard in the telephone receiver. The procedure is to disconnect the transformer ground, and while a man is opening and closing this connection at regular intervals a lineman climbs the pole and listens on each outside wire. The leg which is carrying the ground current can be easily determined by the intermittent buzzing in the telephone receiver. By following this wire and listening in every few poles the service which is grounded can be quickly located. By opening and closing the ground connection at the transformer pole at regular intervals the ground current can be easily distinguished from whatever load current the line may be carrying by the intermittent buzzing just alluded to.

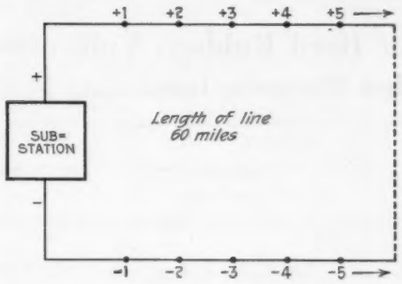
"Shooting" Trouble on Lighting Circuits

ON LONG series circuits a great amount of delay in finding trouble spots, such as grounds, often occurs. The Detroit Edison Company has worked out a scheme that applies to such series circuits. One of the company's lighting circuits is 60 miles around. This circuit uses 100-cp. lamps, and it would normally require eight hours to ten hours to patrol the circuit in order to locate a ground.

The method used is to number each lamp around the loop, as shown in the illustration, and record on a card these numbers and also the normal voltage drop, with an allowance for line loss, opposite each number. As an example, if there are 250 lamps:

+ 1 = 70 volts,	— 1 = 70 volts,
+ 2 = 139 volts,	— 2 = 139 volts,
+ 3 = 208 volts, etc.	— 3 = 208 volts, etc.

For normal operation the total voltage might add to say 4,356 in either direction. If a ground occurs, the transformer is set in the normal position at the substation, and if the measured voltage from side to ground is, for example, 2,320 volts, the card record would show this to be lamp number + 42. If the same measurements are made on the — side and reading is 2,042, for example, the card shows this to indicate lamp — 43. The trouble should be at lamp 42 or 43, and experience with the system has shown that the ground on the circuit is usually to be found within a distance of three lamps.



LOCATING GROUND ON STREET LIGHTING BY TAKING VOLTAGE READINGS

Extracts from an Operating Code*

Repairing and Inspecting Storage Batteries

THE principal causes of low voltages and specific gravity in individual cells are sulphation and short-circuiting. Sulphation is indicated by very low voltage (1.95 volts on floating battery, 1.3 volts or lower on discharge), very low specific gravity (0.030 or more lower than the normal value) and marked change in color of both plates (usually to a very light brown on the positive plate and to a very light gray on the negative plate). A short circuit is accompanied by similar low voltage, but not by marked lowering of the specific gravity unless it is long continued. The color of the plates in a short-circuited cell tends to become the same on both positive and negative plates. Sulphation is usually caused by excessive discharge, by leaving the battery too long in a discharged condition or by insufficient charging.

Treatment for Cells Whose Voltage or Specific Gravity Are Seriously Low

1. When the plates of a cell become sulphated cut the cell out of service; substitute water for the electrolyte.
2. Charge the cell until there is no further increases in specific gravity.
3. If the sulphation is so deep as not to have been all removed by this operation, again substitute water for the electrolyte.
4. Charge the cell until there is no further increase in specific gravity.
5. Repeat this operation as often as may be necessary to remove the sulphation.
6. Bring up the specific gravity to the normal value by adding acid.
7. If the plates of a cell become short-circuited owing to bulging of the active material or foreign material between the plates, scrape the plates well with a stick. Remove the deposited material from the bottom of the jar.
8. If the plates of a cell become short-circuited owing to buckling, remove them from the cell and straighten them.

When scraping battery plates of accumulated materials a wooden stick should be used to avoid short-circuiting the plates. Owing to the considerable amount of moisture given off by a battery the humidity in the battery room is very high and condensation occurs upon most objects, especially metal. This being acid in character causes corrosion of metal and also attacks the woodwork. Consequently acid-proof paint should be applied where possible, and vaseline should be used on parts such as connections between cells. Boiled linseed oil is also a good acid and moisture resistant for application to wood. Detailed instructions for cleaning and inspecting batteries follow:

Cleaning and Inspection

1. Wipe off glass covers, jars or tanks and all supporting insulation.
2. Keep the trays dry and clean.
3. After cleaning the wood tanks wipe them with a cloth saturated with boiled linseed oil.
4. Make sure that the overhanging lead on lead-lined tanks is pulled away from the sides of the tanks so that condensation will drop to the floor and not run down the sides of the tanks.
5. Coat the inside of the glass jars with vaseline about ½ in. down from the top.
6. Copper busbars and any other metal, except the connection between cells, which are exposed to acid fumes must be coated with acid-proof paint.
7. Wooden racks should have the same treatment.
8. The connections between cells should have a light coat of vaseline.
9. Wash the racks and the floor occasionally with bicarbonate of soda to prevent damage from acid.
10. Inspect the cells frequently for sulphation and internal short-circuits.
11. Keep all material from bridging the space between the plates or building up on the bottom of the jar or tank. A wooden stick passed between the plates and scraped over the bottom of the jar or tank will prevent a dangerous accumulation of such material. Never use a piece of metal for this purpose.
12. Fill the automatic pilot cell filler as often as is necessary to replace evaporation.

*Abstracted from the operating code of the Philadelphia Electric Company.

Instructions for Operating Air Pumps

FOR evacuating a condenser an air ejector is first used because it will handle a considerable volume of air against low vacuum. When 10 in. to 15 in. of vacuum is obtained by the ejector the air pump is brought into service since it will handle a smaller quantity of air against a high vacuum much more efficiently. To seal the bearings properly against the admission of air, water is used in the packing glands, which is discharged with the regular discharge of the pumps.

Starting Air Pumps

1. Admit water to seals of pump.
2. Open the hurling water-suction valve until the desired pressure is reached.
3. Start the air pump at low speed.
4. See that the oil rings on all bearings are revolving.
5. Bring the air pump to normal speed and note the vacuum produced by the air pump.
6. Open the air-suction valve slowly.

Shutting Down

1. Close the air-suction valve.
2. Stop the pumps.
3. Shut off the water from the seals.
4. Close the hurling water-suction valve after the pump has come to rest.

Comparison of Properties of Hard Rubber, Vulcanized Fiber and Laminated and Molded Phenolic Insulating Materials

Properties	Hard Rubber	Vulcanized Fiber	Phenolic Insulating Materials	
			Laminated	Molded
Surface restivity at 50 per cent relative humidity, ohms	10^{12} to $>10^{15}$		10^{11}	10^{11}
Phase difference (ψ) at radio frequencies, degrees	0.5	3.0 to	1.5 to 4.0	1.5 to 4.0
Dielectric constant (K) at radio frequencies	3.0	5.0	4.5 to 6.0	5.0 to 7.5
Dielectric strength (volts/mm.)	10,000 to 38,000	9,00 to 16,000	27,000 to 45,000	9,000 to 40,000
Tensile strength (lb./in.^{2})	3,500 to 6,500	9,000 to 20,000	10,000 to 25,000	3,500 to 7,000
Water absorbed in 24 hours, percentage by weight	0.02	26 to 45	0.2 to 1.0	0.05 to 0.2
Density (g/cm.^{3})	1.12 to 1.40	1.3 to 1.5	1.3 to 1.4	1.3 to 1.4
Thermal expansivity (at 20 deg. to 60 deg. C.)	60 to 80×10^{-6}	27×10^{-6}	20 to 30×10^{-6}	25 to 45×10^{-6}
Effect of age	Deteriorates slowly, but if properly vulcanized and protected from the light it is not affected	Improves in quality by seasoning	Improves	No depreciation in physical or chemical properties; slight increase in hardness
Heat	At 65.5 deg. C. (150 deg. F.) pure hard rubber softens perceptibly; at 100 deg. C. (212 deg. F.) it is so soft it may be bent easily; at 115.5 deg. C. (240 deg. F.) it becomes leathery and may readily be cut with a knife; melts at 200 deg. C. (392 deg. F.)	Will not melt under any circumstances; not readily inflammable; at very high temperature chars and becomes brittle; active combustion begins at about 343 deg. C. (650 deg. F.)	Not readily inflammable; will withstand continuously a temperature of 149 deg. C. (300 deg. F.); heat tends to complete the reaction and volatile substances are driven off; hence, when cooled it shrinks considerably and may split; shrinks and loses in weight above 60 deg. C.	See statement for laminated materials
Moist air	Hard-rubber compounds excepting those containing organic substances other than rubber are practically moisture-proof	Absorbs water freely, but without permanent injury; while saturated it becomes soft and flexible and swells; warps and twists upon drying	Absorbs slight amount of water, reducing dielectric properties.	Absorbs slight amount of water, reducing dielectric properties
Steam	The only effect is that due to the high temperature	Same as above, except absorption is more rapid	Best grades not affected beyond slight absorption of moisture; after a few days in steam the cheaper grades will swell appreciably and split; superheated steam tends to warp and blister all grades of the material	Absorbs a slight amount of moisture; if steam is superheated, the high temperature will cause decomposition.
Solvents:				
Acetone	Attacks, dissolving oils and free sulphur	No permanent effect	No effect	No effect
Alcohol	Attacks to a slight degree	No permanent effect	No effect	No effect
Ammonia	No effect	No permanent effect	Strong solutions may cause material to swell	No effect other than slight absorption of moisture
Analine	Softens it at ordinary temperature	Not known	Probably no effect	Probably no effect
Benzol	Softens it at ordinary temperature	No permanent effect	Probably no effect	Probably no effect
Carbon bisulphide	Dissolves small amount of hard rubber and any free sulphur	No permanent effect	Probably no effect	Probably no effect
Ether	Dissolves small amount of hard rubber and any free sulphur	No permanent effect	No effect	Probably no effect
Naphtha	Softens and swells to slight extent	No permanent effect	Probably no effect	Probably no effect
Oil of turpentine	Dissolves in boiling oil	No permanent effect	Probably no effect	Probably no effect
Oil:				
Mineral	Slight softening	Slight absorption	Practically impervious	Practically impervious
Organic	Unaffected	Slight absorption	Practically impervious	Practically impervious
Effect of weak acids	Unaffected	Swells due to absorbed water; may be attacked after some time	Practically unaffected except for absorption of water	Practically unaffected
Weak caustic alkalis	Unaffected	Swells due to absorbed water; may be attacked after some time	Does not successfully resist the action of alkali unless very dilute	Does not successfully resist the action of alkali unless very dilute
Stronger acids (HNO_3, HCl, H_2SO_4)	Not attacked by concentrated hydrochloric, hydrofluoric, acetic acids; not attacked by sulphuric acid of less than 1.50 specific gravity or nitric acid of less than 1.12 specific gravity	Cellulose fiber attacked; soon decomposes	Decomposes; rapidity depends on specific gravity and temperature of acid	Decomposes; rapidity depends on specific gravity and temperature of acid
Stronger caustic alkalis	No effect	Cellulose fiber attacked; soon decomposes	Binder and filler decompose	Completely destroys; speed of the reaction depends on the strength of the solution
Ozone	Oxidizes and soon ruins it for electrical purposes	No effect	Not known	Not known
Metallic inserts	Rapidly deteriorated by contact with iron or copper, the metals themselves being corroded; the inserts should be coated with tin, paper, unvulcanized rubber or other mutually protecting medium	No effect	No effect	No effect
Machining qualities	Admits of a high polish; machines less accurately than would be supposed, due to great resiliency; the better the grade the more readily it is machined; quality may be judged roughly by color and texture, toughness, color and grain of a shaving; has tendency to warp; can be molded but not accurately to size	Admits of a fine finish; may be sawed, punched, drilled, stamped, embossed, turned, planed, bent, tapped; tough, resists shock; cannot be molded	Admits of a good polish; can be sawed, punched, drilled, stamped, turned, planed, knurled, embossed, milled, tapped either with or against the grain, though not as easily as hard rubber and vulcanized fiber; tough, resists shock; can not be molded	Admits of a fine lasting polish; can be machined, cut, filed, sawed with difficulty; can be molded accurately to size; quite brittle
Cost	About $2 per pound in sheet form	50 to 80 cents per pound up to 1 in. in thickness; about $5 per pound for 2 in. in thickness	About $1 per pound	Cost varies with complexity of steel molds

Résumé of the Properties of Electrical Insulating Materials

A COMPARATIVE summary of the properties of hard rubber, vulcanized fiber and laminated and molded phenolic insulated materials is given in the table on page 544. This is based upon the results of many investigations and the experience of many users and manufacturers and has been compiled by J. H. Dellinger and J. L. Preston of the Bureau of Standards and brought together with other information on these materials in *Technologic Paper No.* 216 of the Bureau of Standards. Some of their observations follow.

The problem of the proper use of the proper insulating material has been at once facilitated and complicated by the advent of the laminated and molded phenolic materials. These materials lend themselves to many uses not satisfactorily filled by either hard rubber or vulcanized fiber, but they are likewise used where hard rubber or fiber might better be used. The phenolic insulating materials are for many purposes not hard-rubber substitutes. They are distinctly different. It is evident that the idea of phenolic insulating materials as a hard-rubber substitute has been overworked. This tendency may well be explained on the ground that the phenolic insulating materials are really quite new and yet in a state of development. Engineers have turned to this new material but have found little data at hand to direct them in its use.

The several makes and many grades of laminated phenolic insulating material are discussed quite fully in the paper. It is evident that any numerical value or statement given in the table is an approximation.

The molded phenolic insulating materials are subject to as many variations as hard rubber. There is probably not so much variation in the phenolic resin binder in the molded phenolic materials as there is in the crude or reclaimed rubber binder of hard rubber. There are many other chances for variation in the press pressure and temperature, length of curing in the presses and kind and quality of filler.

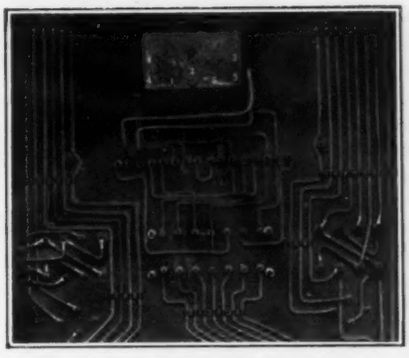
Most of the numerical data given are from tests made at the Bureau of Standards. The statements concerning the effects of various factors on the different insulating materials are based on the experience of various members of the Bureau of Standards staff and upon the experience of the manufacturers of these materials. The manufacturers' experience with hard rubber and vulcanized fiber extends over many years, while the experience with the phenolic insulating materials is much more limited.

While it is possible to make up insulating materials which would give results different from those recorded for any particular property, yet it is believed that this table gives information in a condensed form which will serve to show some of the limitations as well as some of the possibilities of these various materials as now obtainable commercially.

Reactive Component Meters Used by Erie Company

BY J. P. GALLAGHER
Superintendent of Meter Department, Erie Lighting Company, Erie, Pa.

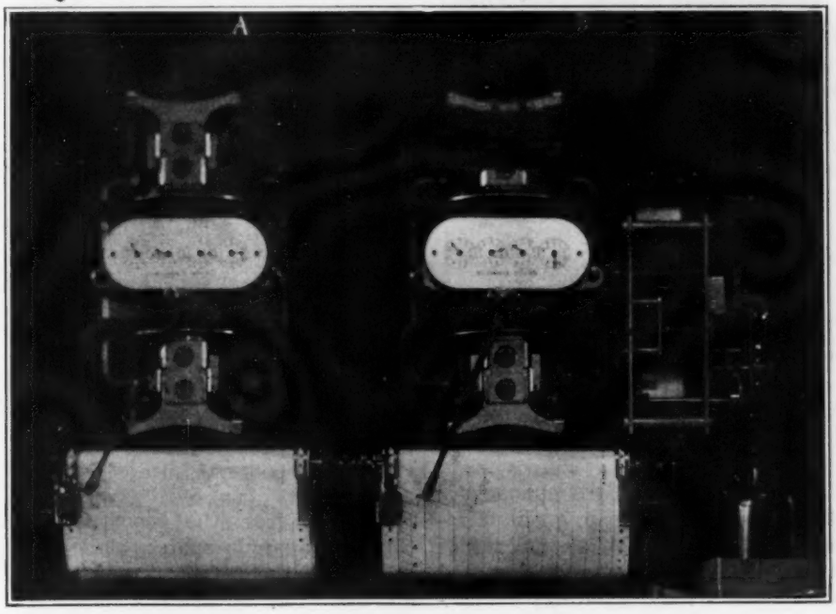
THE growing tendency of central-station companies to take into consideration the power factor of the customer's load in making rates has brought about the need of definite means of demonstrating to the satisfaction of the customer the effect of the actual and apparent power. After a careful consideration of the many methods offered, both direct and indirect, for the commercial measurement and determining of those factors which affect the cost of power service, the Erie Lighting Company, Erie, Pa., has installed a combination instrument (shown in the illustration) connected through a States block to a 3,000-hp. load.



BACK OF COMPONENT METER BOARD WITH REACTIVE COMPENSATOR

The instrument is of the block-interval type with a negligible time elapse between adjacent blocks, giving an integrated and indicated record of the reactive and power components of the system. The accuracy in the measurement of the various factors mentioned is comparable with that of the present high standard of watt-hour meters.

There seems to be a well-defined opinion existing in the industry that the power factor that is really wanted is that at the time of maximum demand. Since the ratio of the reactive to the power component of the circuit is the tangent of the angle whose cosine is the power factor of the system, then the



COMPONENT METER APPARATUS FOR 3,000-HP. LOAD

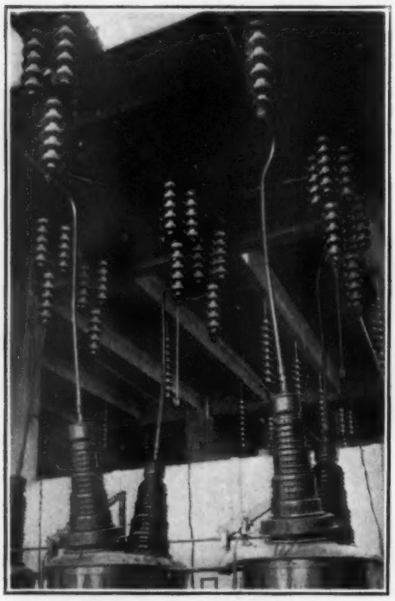
Element A measures the kilowatts or power in the circuit. Element B measures the reactive kilowatt-amperes. The operating power factor is 43 per cent; the average over the entire period is 53 per cent and at the time of maximum demand 70.7 per cent.

square root of the sum of the square of those factors equals the kva. with a synchronous chart travel. The kva., kw., power factor and reactive kva., at the time of maximum demand, are easily computed. It is also simple to demonstrate to the customer the possibility of a lower power factor at the time of maximum demand than the average for the billing period. In making calculations by this method it will be necessary to employ trigonometric tables. The relation between cosine and tangent, however, can be plotted in the form of a curve and be conveniently used by those not familiar with such tables.

All in all, the instrument referred to covers the field in the most complete fashion of all methods that have come to the writer's attention.

Pillar-Type Insulator for 150-Kv. Bus Structure

IN REBUILDING the 150,000-volt bus in the Eagle Rock substation of the Southern California Edison Company after the fire last January bus supports made up of pillar-type insulator units were used. The manner of installing the bus supports is shown in the accompanying illustration. This type of bus support not only has the necessary rigidity and mechanical strength, but has the further advantage that it is made up of standard insulator units which may be easily replaced when they become defective. The supports were made up in the company's shops and are composed of five porcelain pillar-type insulator units in each leg of the support. Three such legs are mounted on the ceiling in the form of a triangle with a steel plate at the lower end. To this plate is attached a single five-unit leg for supporting the bus. A similar type of support was used for the 220,000-volt bus in the Big Creek, No. 8, power house.



DEFECTIVE INSULATOR UNITS ARE EASILY REPLACED IN THIS TYPE OF BUS SUPPORT

THIS EQUIPMENT SETS AN AVERAGE OF FORTY-EIGHT 50-FT. POLES DAILY

Increasing the Rate of Setting Poles

BY C. H. KRETZ
Vice-President Oklahoma Power Company, Okmulgee, Okla.

BY THE use of an unusual arrangement for raising poles the Oklahoma Power Company has been able to erect forty-eight poles in rough country in an eight-hour day with only two men. This equipment was designed for erecting 50-ft. poles, while with a longer boom 60-ft. poles can be set. The A-frame illustrated was constructed of 3-in. x 3-in. x 12-ft. angle irons, while the braces were made of 2-in. x 2-in. x 12-ft. angle iron. The foot of the A-frame was attached to the channel irons of the chassis and the braces were fastened back to the body. The apparatus is assembled with pins and cotter keys so as to be erected quickly.

A cable from the boom is run through a single snatch block near the top of the A-frame and then to a drum. This boom has a sheave set in the upper end of it and is provided with a socket joint on the bottom end. The boom is easily attached to the truck by inserting the socket on the bottom of the boom over the ball, which is a part of all standard Warner trailer hitches. This in turn is attached to the chassis of the truck.

When building new transmission lines, a steel cable is used, but when erecting city lines, where work is done in close proximity to energized wires, a 1¼-in. manila rope is substituted for the steel cable. This manila rope is wound over and on top of the permanent steel cable on the winch drum. By using this apparatus poles can be set at a maximum distance of 18 ft. from the rear of the truck, thereby enabling the line gang to set poles across a ravine or ditch while the truck remains on the main highway.

The parts can be assembled or taken down in about fifteen minutes. No detailed cost data have been kept, since only four pieces of angle iron were required, which were readily available in the company's shops. The labor cost was estimated to be about equal to the material cost. This apparatus is mounted on a 2-ton White truck equipped with a power winch driven by the engine.

This power winch has also been employed for pulling out copper wire by attaching a belt from the pulley on the winch to the pulley which is fastened to the reel. In taking down wire on a transmission line it is cut in sections of about a mile in length, then started around the reel, which is driven from the power winch by a belt so that tension on the belt is adjusted. The belt tension is then regulated so as to slip when too great a strain is put on the wire. The same apparatus can be used in pulling in the wire.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Merchandising and Public Relations the Chief Issues

S. M. Kennedy, Vice-President Southern California Edison, Frankly Discusses the Company's 40,000 New Customers and the Problem of Who Should Sell Appliances

THE Southern California Edison Company will connect up this year, in territory served outside of Los Angeles and Pasadena, from thirty-five thousand to forty thousand residents and commercial customers. Within the two cities named the company sells energy at wholesale only. The increase in connected load from new business signed up exclusive of socket appliances will probably amount to more than 200,000 hp. Already 156,000 hp. has been taken on the lines. This information was given to a representative of the ELECTRICAL WORLD by S. M. Kennedy, vice-president in charge of new business and customer relations of the Southern California Edison Company, who has just visited New York, where he attended several important meetings.

"At the beginning of the year the expectation was that 100,000 hp. would be the increase for the year," said Mr. Kennedy, "and it was estimated that this would mean $15,000,000 in business to the electrical industry of the section in the purchase of material, supplies and labor. This does not include the cost of development or transmission, but the expense of distribution and whatever the customer would spend for wiring, appliances and equipment. Before the year is over, therefore, at least $30,000,000 in productive business will have been created through this activity on the part of the central station for the one year's work, and the contractor, the dealer, the jobber, the manufacturer and the local laborer will enjoy the benefits. This does not include large budget appropriations which will be spent for power development, generation, transmission and substation buildings and equipment.

Asked what he considered the most vital issues before the central-station industry today, Mr. Kennedy stated emphatically that in his opinion the problems of merchandising and public relations deserve first place in the attention of central-station executives and that he considered the two of equal importance. "The matter of local trade relations—that is, the relationship between the various classes of electrical men within a community—is also of prime importance," said Mr. Kennedy. "It is becoming almost as important as the other two. We are standardized pretty well now on electrical methods. We can get all the money we want and all the material.

THREE IMMEDIATE NEEDS

"What we will all need most urgently to develop in the years immediately ahead are proper methods of merchandising, a better basis of co-operative organization between the central station and the contractors, dealers, jobbers and manufacturers, and with it all a higher degree of understanding and harmony in our public relations. There has been a tendency to put merchandising aside. It has been considered a secondary or a tertiary matter by too many utilities, but our experience in Los Angeles has proved that it is a very vital matter.

"Five or six years ago the average annual income from a residence customer or an apartment consumer in our territory was eight dollars less than it is today. The growth is due almost entirely to the greater use of the many lamp socket appliances, additional income, improved load factor and better diversity factor. The value of such an increase is obvious.

"We estimate conservatively that there are four hundred thousand small household appliances on the lines in our territory. We calculate that we receive from each of these appliances an average income of one cent per day and therefore that we are selling $4,000 worth of energy each day to serve this household equipment. We believe that this is the largest installation of electrical domestic appliances in use in any community at the present time.

"The question naturally arises, Are these appliances used? We believe that they are, as the result of the surveys which we have made throughout our territory and the contact which our greater-service department maintains with our customers. It will be remembered that in 1906 our company placed an order for five thousand flatirons to be loaned to our customers. We did not stop until ten thousand had been put out on our lines. As a matter of fact, however, these appliances, which were really loaned to the consumers, were nearly all sold to the people who had been using them. Of course we have an exceptionally good country for the sale of this equipment. It is a new country with new houses and a class of people who go there in the spirit of enjoying themselves and with the desire to get along with the smallest possible amount of work.

WHO CAN MERCHANDISE BEST?

"Our experience has convinced us that there is nothing more important in the development of our company and our service to the public than a properly organized merchandising influence. Every appliance we put out makes us more important and useful to the customer and increases our contact with him. This brings with it, of course, an increased responsibility in the matter of public relations, for the more necessary you make yourself to the customer the more opportunity there will be for poor service to give annoyance and the more particular the utility must be to maintain a high degree of efficiency. At the same time, this closer contact and greater dependence on electric service on the part of the customer brings tremendous support in public relations. Let the customer be continually irritated by not getting what he wants and he listens to the agitator with a willing ear, but if the utility gives good service and

the householder recognizes his dependence upon it and appreciates the spirit in which he is served, then public ownership talk does not lodge in his mind.

"The problem is, of course, as to who should and can best do this merchandising of appliances. Some years ago the Southern California Edison Company withdrew from the sale of appliances in the interests of the local contractor dealers. We felt that if the opportunity of these men to make a larger thing of their retail business were increased they would be encouraged to put more time and thought and effort behind it. We are not satisfied, however, that under these conditions this market is being adequately served. As I said, we are connecting thirty-five thousand new household customers this year, and no one is going after them with sufficient energy to sell them the complete equipment which they require and would desire if they were properly approached and educated.

"This presents a very serious problem in which the entire industry is concerned. The question of whether the market is best served when the central-station company itself conducts an aggressive merchandising department, maintaining proper merchandising policies for the protection and encouragement of the local contractor-dealers and stimulating them by the example of a good store and good merchandising practices, has not yet been decided. One thing that the industry must bring itself to see is that it is not only in the public interest but in the interest of all electrical men that hardware stores, department stores and all ordinary sources of household equipment and supplies be encouraged to sell electrical appliances just as fast as each device reaches a staple stage where it can be sold as merchandise without any large amount of instruction or service.

"It is no time now for the electrical dealer or contractor to be sore because others are getting into the business. The market itself is greater than the electrical stores alone can hope to serve in the near future, and if we tie these added sources of supply into our public-relations picture by giving them sufficient intelligent co-operation and support, the merchandising of electrical appliances cannot be held back. Every appliance sold means more business, not only to the central stations, but to wiring contractors and dealers who sell other devices in which the customer will next become interested.

"As a result of all this we feel that the vital issue is merchandising and public relations. We believe that our experience will be repeated in every community and that great gains can be made by recognizing right now the considerable importance of setting up a proper merchandising situation so that the public may be adequately served and the market opened up without loss of time. For when we lose time in educating the public to use electric household appliances we are denying them a service to which they are entitled and losing ourselves income and growth of vital value to our stockholders."

Mr. Kennedy is a strong believer in co-operation and harmony in all branches of the industry in his part of the world, and any further development work in electrical merchandising, he says, must be carried out with the approval of all concerned. When asked about customer ownership, Mr. Kennedy said that in his opinion that was the ideal form of public ownership. He added that the Southern California Edison Company has now more than sixty thousand stockholders.

Electric Home Economics Now a High-School Course

HOME economics students in the new Keokuk (Iowa) High School will be taught how to purchase utility service economically just as they are taught how to shop for their groceries, according to an announcement made by the school board recently.

The Keokuk Electric Company, operated by Stone & Webster, has offered to electrify the home economics department of the new school so that students can be taught every known utilization of electricity for home convenience. Every appliance from a curling iron to a large electric range will be placed at the students' disposal.

Both gas and electric meters will be installed, and the students will be taught how to read their meters, figure their bills and practice economy in buying electricity.

The installation of this new branch of domestic science work has just begun in several schools of the country, and Keokuk will be one of the first in its state to offer the service.

Giving the Fuel Problem Personality

A REAL "human interest" story of the central-station coal problem is being told by the Edison Electric Illuminating Company of Boston in display advertising carried in the local press in connection with a series of announcements devoted to pointing out the co-operative interests of the company and the public in community and system development. Taking "Old King Coal" as its theme, the company contrasts the efficiency of electrical production from a large station with the inability of the small user to extract as many kilowatt-hours from a given weight of fuel and shows how the modern central station fundamentally serves the community more efficiently by its wholesale production of energy. The storage facilities in the present plant and those to be provided in the new Weymouth station are cited, with terse comment upon the demand growing business makes upon the fuel resources of a great public utility.

The Friendly Glow

Making the King earn his pay

WHEREVER an electric light burns, or a heater glows in a garage or the bathroom, wherever a motor is humming or a fan spinning—there Old King Coal is working for you.

He's a touchy old soul. He does magnificent work, but he has to be handled scientifically to earn his pay. And it is our duty to you to make him work, and make him earn it.

ON December 21, 1922, Boston Edison made 1,700 tons of coal supply you with more electricity than you had ever used before in one day. That is an average of 22 pounds of coal for every Boston Edison customer.

IF you had bought 22 pounds of coal that day, and tried to make it furnish your electricity for the day, Old King Coal would have balked.

If your factory, or your office building, had to make electricity out of no more coal than we used to supply light and heat and power for that building, waste would eat up the coal before all the electricity had been produced.

For it is extravagantly wasteful if not almost impossible to use coal in small quantities to make electricity. The more coal you can use under scientific control, the more you can make its electricity do for every cent paid for coal.

Boston Edison buys only the pick of the mines; always has thousands of tons in reserve; handles it by machinery alone from the moment it leaves the mines, unloads it at eight tons a minute, feeds it to the boilers on moving belts and automatic grates (the company need not own a shovel), and burns it almost to the last grain. We study Old King Coal; we take the best of him, and get more out of him for you each year. You rarely see smoke from our chimneys at L Street Station—because the energy in that coal is not allowed to go up in smoke.

OLD King Coal works best on a man's-size job, like making Greater Boston *greater*. That's why there is storage space at the new station at Weymouth for 300,000 tons.

While Greater Boston continues to grow, and the two million of us use more and more electricity to make it grow, we'll keep Old King Coal at work. And we'll continue to make him earn his pay.

EDISON LIGHT

BOSTON EDISON TELLS OF ITS EFFICIENT USE OF COAL

Students Are Shown Through Substation

APPRECIATING the educational value of showing visitors through its substations and power plants, the Idaho Power Company, Boise, has for some time made a practice of conducting inspection tours over its system. Business men, civic and commercial organizations and other interested persons have been the guests of the company on these occasions. Recently one hundred students of the Boise summer normal school were taken on an inspection trip to the company's main terminal substation in Boise. Members of the engineering department escorted the party through the plant and explained its functions and operation.

The range of questions asked by the students indicated a considerable knowledge of the theory and operation of a power system. A handsome illustrated booklet, entitled "Boise's Power Terminal," was given to each member of the party.

NORMAL SCHOOL STUDENTS ON TOUR OF INSPECTION AT THE IDAHO POWER COMPANY'S SUBSTATION

Three Letters that Tell Their Own Story

May 8, 1923.

Attention New-Business Manager.
BROWN ELECTRIC COMPANY.

GENTLEMEN: Under separate cover I am forwarding to you photostats of the contemplated house wiring which I am planning to install in my father's home, 51 Jones Avenue, during my vacation the last two weeks in June. My purpose in bringing these plans to your attention is that possibly you might suggest some further additions or conveniences I have overlooked in the wiring of this house. Any suggestions or criticisms you may desire to make will be appreciated.

Another matter on which I should like further information is this: Does your company handle the housewiring contracts directly or through some local contractor-dealer? If you do the wiring yourself, have you any deferred time-payment arrangement? I shall appreciate your advising me what system your company uses. Very sincerely yours, JOHN DOE.

May 29, 1923.

MR. RICHARD ROE, Manager
Brown Electric Company.

DEAR MR. ROE: Not having received any reply from my letter addressed to your new-business manager relative to your rates on house wiring, I am writing you direct for further information on this subject. On May 8 I also sent along some photostats of the contemplated house-wiring plan which I intend to install in my father's home at 51 Jones Avenue, during my vacation the last two weeks in June. My purpose in bringing these plans to your new-business manager's attention was that possibly he might have some suggestions in regard to the addition of more outlets or conveniences. Since the time is growing short between the end of June and the present, I shall appreciate any suggestions and criticisms you might make on these plans. If these plans have miscarried in the mails, I can furnish you with an extra copy.

Another item on which I wanted some more information was this: Does the Brown Electric Company handle the house-wiring contracts directly or shunt them to local contractors? And if you do the wiring yourselves, have you any arrangement on deferred-time payments? The reason I wanted this work done during my vacation was that I could possibly help in the work and direct some of the construction, since I wanted the installation finished before I must return to my work.

I will appreciate most keenly any information you can give me on this matter since I would like to let the contracts as soon as possible in order to start the work by June 19. Sincerely yours, JOHN DOE.

May 31, 1923.

MR. JOHN DOE.

DEAR SIR: Answering yours under date of May 29, I beg to advise that no communication from you has been received at this office. Very truly yours,
BROWN ELECTRIC COMPANY.
By Richard Roe, Manager.

What Other Companies Are Doing

Pawtucket, R. I. — About 5,000 persons visited a "Home Practical" in this city during a three-week exhibition under the direction of H. E. Dawson, secretary of the Rhode Island Electrical League, which included a large amount of electrical equipment in addition to gas-operated devices in which the Blackstone Valley Gas & Electric Company, operating in this section of the state, is interested. The electrical equipment included a washer, motor-driven ironer, ice-cream freezer, automatic refrigerator, fans, lamps, heating pads, pilot lamps, electric clock and other devices.

Malden, Mass.—The Malden Electric Company has established its sales department as a complete unit operating at an address independent of the main office of the company through the opening of an appliance store at 145 Pleasant Street, Malden. The new store contains an appliance stock room, service department, quarters for the advertising department and the new-business department, with records.

Portsmouth, N. H.—A new interconnection contract between the Rockingham County Light & Power Company and the Twin State Gas & Electric Company of Dover, N. H., enables the week-end load on certain of the Portsmouth company's feeders to be handled efficiently by utilizing surplus hydro-electric energy from the Dover system, so long as the amount of energy delivered does not exceed the load on these feeders. A new tie line is under construction to Dover with increased copper cross-section, and it is hoped to provide for a still more satisfactory utilization of surplus power when this is completed.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Big Falls Development on Flambeau River.—L. B. BREEDLOVE.—A three-unit plant of 9,900 kva. capacity, operating under a net head of 52 ft. with an average flow of 1,600 sec.ft., is to be tied in with four other hydro-electric developments of the Lake Superior District Power Company. Two 3,300-kva. units are now installed. Interesting features described are the dam and spillway construction and the special reinforcing of the scroll case by means of steel bands secured to the rim of the speed ring.—*Power*, July 17, 1923.

Some Engineering Features of the Weymouth Station. — I. E. MOULTROP and JOSEPH POPE. — A five-page abstract of this paper presented at the summer convention of the A. I. E. E. may be found in the ELECTRICAL WORLD for July 7, 1923, on page 9.—*Journal of the A. I. E. E.*, August, 1923.

Sectionalization and Remote Control of High-Pressure Steam Lines.—P. P. DEAN.—The purpose of this paper is to bring out the need of protection other than that of hand-operated valves for high-pressure steam lines in case of failure of pipe or fittings. It deals with the remote operation of various types of valves by electric motor or steam piston in order to stop escaping steam quickly and safely. It is based on a careful study of valve construction and methods of power operation made by the author during the last few years and on experience gained with a large number of electrically operated valve installations which have been placed in nearly all the important power-generating stations in the country, and it gives particulars regarding construction of various protective devices, valves and motor-control systems that are available. — *Mechanical Engineering*, August, 1923.

Largest Steam-Turbo Generator in England.—F. KONN.—What is claimed to be the largest generating set in England has recently been put in operation in Rotherham. The turbine is rated at 40,000 kva., 1,500 r.p.m., 6,600 volts, 50 cycles, three-phase. The stator was tested with 14,200 volts between each phase and ground. The rotor withstood 1,500 volts for one minute while driven at 15 per cent overspeed. The generator is self-cooled, that is, its heat losses are dissipated within permissible thermal limits without any external blower. The internal reactance of the stator winding has been calculated to give five and two-tenths times normal current, or 18,200 amp., under short-circuit condition. This value has been checked by an actually made short circuit with an oscillograph in the line. The resulting oscillographic record is reproduced. The turbine is of the Curtis type, with fourteen stages. The diameter of the largest runner is 12 ft. — *Revue Générale de l'Electricité*, July 28, 1923.

Generation, Control, Switching and Protection

Neon "Glim" Lamps Used as Ground Detectors.—A. KASTALSKI.—If a narrow metal band is placed around a high-voltage bushing near its grounded end and a neon "glim" lamp is connected between this band and ground, the glowing of the lamp will indicate that the line is alive. The width of the metallic band and its distance from the grounded end clamp have to be varied for different operating voltages. On a three-phase wall - entrance bushing three lamps, arranged one for each phase, represent a very inexpensive ground detector. During normal operation all three lamps will burn with their usual brilliancy. In case of a fault or ground on one line the lamp on that phase will become dark. Overvoltages are indicated by intermittent flashing above normal brilliancy. The placing of the metallic band on the insulator should be done in such a way that the flash-over point of the bushing is not reduced.—*Elektrotechnische Zeitschrift*, July 26, 1923.

Distance Relay for Automatically Sectionalizing Electrical Networks. — L. N. CRICHTON.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1028. —*Journal of A. I. E. E.*, August, 1923.

Transmission, Substations and Distribution

Mechanical Properties of Transmission Lines.—IVAR HERLITZ.—The author suggests the use of a simple diagram which facilitates the computation of deflection and stress for a given span under any condition of load and temperature. The customary approximation of replacing the catenary by a parabola is made, and a curve (a cubic parabola) is plotted on the length of the span and the ratio of deflection to length. The intersections of certain straight lines on this curve give corresponding values of length of span, load, temperature, deflection and stress. With certain modifications of the diagram it is also possible to take into account different moduli of elasticity.—*Teknisk Tidskrift (Swedish), Elektroteknik*, July 7, 1923.

High-Voltage Lines in Mountainous Terrain.—H. GRÜNHOLZ.—This paper describes some of the problems which may be expected on a 50,000-volt, three-phase transmission line traversing mountainous regions. Elaborate calculations are given for the exact determination of the sag of lines spanned over an inclined ground, as, for example, on the slope of a mountain. The distribution and the magnitude of forces which result from unequal distance between adjacent towers are shown. Considering the possible side sway of the wire, the best cross-arm arrangement is developed. Suggestions are given for designing towers for long-distance spans in the least expensive way, one method, for example, being to omit the top grounding cable. Storm and sleet conditions are carefully considered.—*Elektrotechnik und Maschinenbau*, July 15, 1923.

Voltages Induced by Arcing Grounds. —J. F. PETERS and J. SLEPIAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1023.—*Journal of the A. I. E. E.*, August, 1923.

Units, Measurements and Instruments

Standardization of Electrical Measuring Instruments.—H. B. BROOKS.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 21.—*Journal of A. I. E. E.*, July, 1923.

Absorption of Moisture by Various Fibrous Insulating Materials. — By utilizing the phenomenon of temperature rise caused by the absorption of moisture comparison is made of several different types of insulating materials. —*Journal of Institute of Electrical Engineers of Japan*, July, 1923.

Methods of Measurement of Properties of Electrical Insulating Materials. —J. H. DELLINGER and J. L. PRESTON. —The properties on which methods of measurements are given are phase difference and dielectric constant, radio frequencies, voltages at radio frequencies, volume resistivity, surface resistivity, density, moisture absorption, tensile strength, transverse strength, hardness, impact strength, permanent distortion, machining qualities, thermal expansivity and effects of chemicals.—*Scientific Paper No.* 471, *Bureau of Standards.*

Illumination

Modern Requirements in Street Lighting.—T. W. ROLPH.—Of particular interest in the paper is a chart showing the expenditure per capita for street lighting in the large and medium-sized cities of this country. A twofold increase in the present expenditure per capita is shown to be highly desirable and, in fact, an almost certain development of the next few years. With such an increase in expenditure and with the use of the most efficient street-lighting equipment installed according to the best modern practice, the streets of our cities can be made essentially as safe and con-

venient by night as by day. Light distribution with various types of reflectors and globes, illumination requirements of streets, the proper location of street-lighting units and the effect of mounting heights in regard to blinding are considered.—*Proceedings of American Society for Municipal Improvement*, 1922.

Quality of Incandescent Lamps.—J. W. HOWELL and HENRY SCHROEDER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 19.—*Journal of A. I. E. E.*, August, 1923.

Illumination and Production.—A revision of the original bulletin contains considerable additional information under the following subjects: Indirect effects of proper lighting, direct effects of high-level lighting, prediction of results due to increasing the intensity of illumination, production tests, factors which affect the result, economics of productive lighting and a lighting survey and bibliography.—*Bulletin L.D. 106A of Edison Lamp Works.*

Motors and Control

Selecting a Railway Motor for a Given Cycle of Duty.—W. G. GORDON.—The author discusses the continuous capacity of railway motors, the effects of the different variables on motor performance and the varying conditions encountered during winter and summer months.—*Electric Railway Journal*, July 14, 1923.

Electric Drive of Rotary Printing Presses.—R. MOHR.—The very exacting requirements of speed regulation within widest limits make specially devised controlling apparatus essential for the drive of large printing presses of the rotary type. Depending upon the size of the press, a motor capacity of from 5 kw. to 50 kw. is required, or several individual motors may even be necessary. Modern presses of the duplex and quadruplex type, with their bulky and long constructions, make it necessary to start, stop and to regulate the drive from several points, so that remote control is used in almost all cases. The article goes into considerable detail concerning the semi-automatic and fully automatic control of direct current, three-phase and single-phase motors for these machines. For alternating-current motors speed regulation by the remotely controlled brush-shifting method is described. Complete wiring diagrams for direct-current and three-phase operation and for a large press drive with four motors are given. Contrary to previous belief, either alternating or direct current is suitable for these drives, provided the right type of motor is chosen. For alternating current the commutator type of motor gives the same economic range of speeds as the direct-current motor. For larger presses manual operation of the controlling apparatus is uneconomical. Fully automatic push-button control at as many points on the press as may be desired has been developed so perfectly as to insure fully reliable operation. Great saving of time, a smooth start and very rare breaks in the paper are advantages which soon pay for the initial cost of an automatic control.—*Siemens Zeitschrift*, July, 1923.

Heat Applications and Material Handling

Recent Developments in Resistance Welding Field.—H. LEMP.—Progress in the electric resistance welding field during the past year has been more in the application of known apparatus than in any radical departure from existing methods. A review is given of butt and flash welding, spot welding, seam welding, percussive welding, welding high-speed tool steel to ordinary shanks and the welding of pipes.—*Journal of American Welding Society*, June, 1923.

High-Speed Tool Steel Electrically Welded to Machine Steel.—Very material savings can be realized in the cost of cutting tools if a small piece of high-speed steel is welded to a shank of ordinary machine steel. In the past, however, the joint between the piece of high-grade steel and the shank has frequently been found to be very poor, particularly if this joint was made by brazing or by welding in an open fire. Even the electrically welded joint was not always satisfactory. The reason for this was that if the small cutting plate was brought in contact with the usually massive shank and the two were clamped between the electrodes of the electric welding machine, the current quickly overheated the small plate before the large shank came to proper welding temperature. This not only resulted in a poor joint but usually burned the high-grade steel plate. To overcome this difficulty the small plate is held firmly in a large copper block which surrounds it on three sides. The shank, on the other hand, is held lightly in a block of wrought iron. The large copper clamp will carry the heat away from the small cutting plate at such a rate that both pieces will become heated at about the same time. Cutters made with this clamping method show a perfect joint and stand up well even under fast feeding of the tool. The energy required for such a weld is about 31 kw.-sec. per square centimeter of welding surface. Hardened plates may be welded to the shank by this method without necessitating retempering.—*A. E. G. Mitteilungen*, July, 1923.

Electrophysics, Electrochemistry and Batteries

Magnetic Material of Very High Permeability.—H. D. ARNOLD and G. W. ELMEN.—The magnetic alloy described is a composition of about 78.5 per cent nickel and 21.5 per cent iron, and at magnetizing fields in the neighborhood of 0.04 gauss and with proper treatment it has a permeability running as high as 90,000. This is about two hundred times as great as the permeability of the best iron for these low magnetizing fields. This high permeability is attendant upon proper heat treatment and also upon other factors, among which is freedom from elastic strain. The presence of other elements than iron or nickel, and especially carbon, reduces the permeability, but slight variations in heat treatment produce large changes compared with those due to small quantities of impurities. The equilibrium diagram, electric conductivity, crystal structure, mean spacing between adjacent atom centers and density are among the physical properties which have been studied.—*Bell System Technical Journal*, July, 1923.

Traction

Electrification of Foreign Railways.—S. PARKER SMITH.—Taking as his starting point the country which has the largest proportion of its main-line railways electrified, the author traces the history and present development of electric railways in Switzerland. Direct-current, single-phase and three-phase systems are all in operation. The first is represented almost solely by single-track narrow-gage lines at 600/1,500 volts. The three-phase systems are confined to the Burgdorf-Thun and the Simplon Tunnel electrifications. Single-phase systems are most favored, the extensive developments on the Loetschberg, Rhaetian and Federal Railways being all single-phase. The Federal system has in contemplation the complete electrification of 1,529 km. of line by 1928; 429 km. of this has already been completed. The article includes numerous statistical tables and diagrams showing the characteristics of the various types of locomotive in use.—*Beama (England)*, July, 1923.

Telegraphy, Telephony, Radio and Signals

Carrier-Current Radio for Power Lines.—D. DRESSLER.—The usual system for a radio carrier-current communication between power stations makes use of the two-wave principle, which enables two-way conversation. The new system, described in this article, is based upon the single-wave principle. It does not permit two-way talking, but gives the much greater advantage that all substations on the network can be connected, a feature which is said to be impossible with the two-wave system. It gives a much louder communication, which is of value for the safety of operation and the bridging of complex and extended lines. Several "hook-ups" that have been tried out are given.—*Elektrotechnische Zeitschrift*, Aug. 2, 1923.

Super-Regeneration.—E. O. HULBURT.—A simple mathematical analysis of super-regeneration yields conclusions, in accordance with observation, that the super-regenerative system amplifies without distortion and that the amplification increases with increase of signal frequency and with decrease of variation frequency. Two single-tube super-regenerative circuits, interesting because of their simplicity, are described.—*Proceedings of Institute of Radio Engineers*, August, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Artificial Electric Line, Combined T and Π Type

An artificial line with lumped sections may be of either T or Π type and can be made to represent a "smooth" line correctly at one chosen frequency. When the frequency changes, the error in the T line is in the opposite direction from that of the Π line. We therefore have devised a combined T-Π line with which the frequency error is much smaller than for either of the previous types. For details see *Technology Reports* of the Tohoku Imperial University, 1923, Vol. 3, page 133.—*Heichi Nukiyama and Yoji Shoji*, Sendai, Japan.

Cables, Trailing on Coal-Cutting Outfits

In view of an element of danger involved in such cables, a questionnaire has been sent out particularly with the view to comparing "twin" and "concentric" cables. In almost every case concentric all-rubber covered cables were found preferable because they have a longer life, require less repairs, do not kink, do not become water-soaked and can be handled with less liability of shock to the machine operator.—*L. C. Ilsley and H. B. Freeman, Bureau of Mines, Washington, D. C.*

Lamp Fixture, Rigid, for Incandescent Street Lights

With the usual method of suspension, inherited from the old arc lamp, street lamps can swing freely. In stormy nights this swinging often caused breakage of leads because of fatigue stresses and was a source of considerable annoyance and expense. A new solid suspension link has been introduced which completely remedies this trouble.—*Rochester (N. Y.) Gas & Electric Company.*

Metals Fused in Vacuo, Gases, Evolved from

It has been found that the most satisfactory method of heating the metal samples for the extraction of gases under vacuum is by the use of a high-frequency induction furnace. This method of heating has eliminated many of the difficulties and sources of errors common to previous methods of vacuum fusion. The analyses of the evolved gases for oxygen and hydrogen are carried out gravimetrically by the use of a train of solid absorbents which satisfactorily absorbs the gases even at comparatively low pressures as rapidly as they are pumped out of the furnace.—*Bureau of Standards, Washington, D. C.*

Resistance Material of High Resistivity

A new resistance material has been developed in the form of filaments which can be made in the order of 100,000 ohms per inch length. These filaments can be used as grid leaks in radio work and as cheap non-inductive high resistances generally. Telephone protectors have been devised, using this material, which filter out extraneous noise, particularly in connection with alternating-current railway operation. Where the limiting distance between feeder stations is indicated by telephone interference, the use of this new resistence material would make it possible to increase the distance between such feeder stations, and therefore reduce the cost of the installation as a whole.—*C. E. Skinner, Westinghouse Electric & Manufacturing Company, Pittsburgh.*

Safety Switch for Arc Welding

One of the notable achievements made during the past year in the field of alternating-current arc-welding apparatus has been the development of a safety switch which cuts the power from the welding line and primary circuit whenever the arc is not being drawn. The voltage at all times during welding is limited to a harmless value such as 30.—*W. L. Warner, American Bureau of Welding.*

Welding Metal to Porcelain or Glass, Process for

Extensive research work carried on by Thomas E. Murray of the New York Edison Company led to the discovery of a new process by which metal may be welded to porcelain or glass in all kinds of electric switches and fittings, giving a more simple and more inexpensive fastening than by use of machine screws or other means. The electric fitting is placed upon the porcelain, a copper rod or rivet is threaded through the fitting or porcelain and a pressure of one-half ton is applied during the space of a quarter of a second. Instantaneous heat is used and the cracking of the porcelain is prevented. The result is the fusing of the copper with the porcelain.—*E. W. Wells, New York Herald.*

In Progress or Purposed

Electrolysis Mitigation

Arrangements have been made with the utilities in Tulsa, Okla., and St. Louis, Mo., for electrolysis investigations to be carried on in those cities with special reference to the pipe-drainage method of electrolysis mitigation. The bureau has recently assisted in an attempt to solve the electrolysis problem in the city of Wilmington, Del. This situation has caused considerable difficulty to the public utilities for a number of years. Some further tests have been planned there, and arrangements made for carrying them out in co-operation with the bureau.—*Bureau of Standards, Washington, D. C.*

Heat Radiation, Reduction of, by Aluminum Paint

Coverings of conveyances, such as the tops of automobiles, ice wagons, etc., consist of cloth, the outside of which is often painted with a black composition which absorbs perhaps 90 per cent of the sun's rays. Practically half of this is re-radiated from the under side of the cloth. Tests are in progress which show that a coating of aluminum paint applied either to the outside or inside of such tops reduces by 50 to 60 per cent the intensity of the heat radiated from the under side into the interior of the conveyance.—*Bureau of Standards, Washington, D. C.*

Heat Radiators, Effect of Paint on

Many heat radiators are painted with aluminum or bronze paint. From the viewpoint of obtaining the maximum amount of heat from a radiator of a given size, this is one of the most inefficient paints that can be applied. Tests in progress on the emissivity of sheet iron covered with white paint, enamel and aluminum paint show that the aluminum paint emits only 27 to 30 per cent as much as a non-metallic paint or enamel.—*Bureau of Standards, Washington, D. C.*

Lamps, Incandescent, Extra-Large

The production of both the 10-kw. and 30-kw. coiled-wire radiator lamps is well through the development stage. Many difficult problems in construction peculiar to large lamps and high temperatures have been solved. A 100-kw. lamp has been designed, but not yet constructed. Prior to a year ago a 3,000-watt lamp was the largest ever in regular production.—*P. G. Nutting, Schenectady, N. Y.*

Street Lighting

A study is being made of the various systems of street lighting used in cities and towns throughout the country. This work is receiving the hearty co-operation of municipalities and operating utilities. Several hundred replies to questionnaires on engineering practice and contract requirements have been received and are being carefully analyzed. Very full engineering data have been furnished by thirty or more of the larger operating companies on the basis of which a survey of the best practice is being prepared as a part of a comprehensive report on street-lighting service.—*Bureau of Standards, Washington, D. C.*

Suggestions for Research

Cable Joints, Petrolatum Absorption Through

Petrolatum, which is used as a filling in high-tension cable joints, is likely to become almost fluid at high temperatures reached in cable operation. Since the paper insulation may be somewhat loose near the joints, owing to bending and handling, there is a possibility of the petrolatum being absorbed into the cable proper. Since the dielectric properties of petrolatum are inferior to those of regular impregnating compounds, the cable is thereby weakened. Experiments are desired on the amount of absorption of petrolatum under different operating conditions and on the resulting change in the dielectric properties of the cable.

Conductivity, Thermal, Increase of, by Ionization

It is known that the electric conductivity of solid dielectrics can be increased by subjecting them to the ionizing action of X-rays. Theoretically, thermal conductivity and electric conductivity should increase and decrease together. If the thermal conductivity could thus be artificially increased, many processes of heating, cooking and cooling could be facilitated. For example, if the thermal conductivity of meat could be increased during the process of cooking, it would take less time and less energy for frying, roasting, etc.

Spark Gaps, External Ionization of

It is well known that air can be ionized by ultra-violet rays or by X-rays. In some European insulation tests with steep wave fronts the sphere gap was exposed to an arc light rich in ultra-violet rays to accelerate the breakdown of the gap. It is possible that such a procedure (or an X-ray tube) may prove useful in some other tests, or even in connection with protective apparatus under actual operating conditions. Thus a comparatively slow protective gap in a station might be subjected to ionizing rays at the approach of a storm, to make it more sensitive and quick acting.

Spark-Over at Different Air Densities

In the design of protective apparatus and insulators it is sometimes necessary to predict their performance at different values of air density, especially at high altitudes. The general law governing the relationship between the spark-over voltage, the air density and the linear dimensions of the apparatus has been given by J. S. Townsend (law of similitude, *Electrician*, 1913, Vol. 71, p. 349). Some experiments have also been made by Peek and others on corona formation and flash-over at different values of air density. It is not known, however, whether the law of similitude is generally valid for complicated shapes used in practice, and a comprehensive series of tests is needed to establish the limits of its validity and to furnish data for its practical application.

Vehicles, Electric, Regenerative Braking of

Now that the regenerative braking of electric railway trains has been perfected, it is time to consider regenerative braking of electric trucks and other battery cars. A small axle-driven generator should be sufficient to excite the fields of the main motor in such a direction as to convert it into a generator for charging the battery. With present-day robust batteries it is possible to use electric vehicles in quite hilly places, but the expense and inconvenience of applying a mechanical brake down a long hill limits their application.

Welding, Arc, Effect of Cooling Rate

Further investigation is needed on the effect of heat treatment on arc welds, for the purpose of securing a better control over residual stress, weld strength, ductility, stress distribution, shock and fatigue resistance.—*O. H. Eschholz, Pittsburgh, Pa.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

For Rural Electrification

Committee of Promotion Is Organized by N. E. L. A., Farm Bureau and Other Interested Bodies

A MOVEMENT to stimulate a complete investigation of the application of electricity to agriculture which has been gaining momentum during the past year was put on a working basis at a meeting held in Chicago on Tuesday of this week and attended by H. M. Aylesworth, Marshall E. Sampsell and G. C. Neff of the National Electric Light Association and O. E. Bradfute, J. W. Coverdale and H. W. Moorehouse of the American Farm Bureau Federation. At this conference final approval was given to the formation of a committee on the relation of electricity to agriculture. This committee will consist of the three representatives of the American Farm Bureau Federation already named and of Marshall E. Sampsell, G. C. Neff, J. C. Martin and Arthur Huntington as representatives of the N. E. L. A.; R. C. Cosgrove, representing the manufacturers of farm electric plants; Prof. J. B. Davidson, representing the American Society of Agricultural Engineers, and S. H. McCrory, representing the United States Department of Agriculture. E. A. White has been employed as director to devote his full time to the work, with an office in the American Farm Bureau headquarters in Chicago.

The formation of this committee brings together various groups which are vitally interested in the problem of rural electrification and for the first time in American history enables the farmer through his own representatives to participate actively in solving the problems met in adopting a new form of power. The committee will endeavor to direct development work along sound economic and engineering lines, eliminating the cut-and-try method, and to insure maximum results at minimum cost. It recognizes that electric service on the farm offers great possibilities for improving living conditions and reducing the cost of production, but before these can be realized there are many economic and engineering problems to be solved.

Farm Power Survey

The first step in this direction taken at the request of the committee has been the undertaking by the United States Department of Agriculture of a national farm power survey to determine the amount of power used in agriculture, the power requirements for various farm operations, the types and sizes of prime movers used, the power requirements of various machines and what operations are still done by hand. Out of this survey should come the fundamental agricultural facts to form the basis for the economic studies and engineering developments necessary. Surveys will be conducted to determine for what operations electricity is used today and also to find out what obstacles stand in the way of its general application to farm operations.

Regarding this work, Mr. Coverdale, who is the secretary of the American Farm Bureau Federation, expressed his conviction that when rural electric lines become as popular as the rural telephone electricity will do as much to lighten the burden of the farmer and his wife as it has done in city homes. The committee, he said, has important work to perform in helping to lay the foundation for the development of rural electricity without exploitation. Mr. Aylesworth declared the electric light and power companies of the United States have already reached more than four hundred thousand rural customers. That, however, is less than 7 per cent of the farms of the nation, and in his opinion they will within eight years serve five hundred thousand additional farms.

Mercury Turbine Starts at Hartford Station

For the first time in electrical history power generated from heated mercury vapor was applied to commercial service when at 12:57 p.m. Sept. 7 the Hartford (Conn.) Electric Light Company phased in its pioneer mercury-turbine unit with other turbines at the Dutch Point and South Meadow stations. About 600 kw. was delivered to the bus.

Commenting upon this event before the New England Division of the N. E. L. A. at Swampscott, Mass., Vice-president Samuel Ferguson stated that this inauguration of commercial service from the mercury turbine marks the beginning of an experiment in central-station prime-mover development which will be continued until conclusions can be drawn as to the future of this type of apparatus in the field of modern electrical energy production. The development is being made by the General Electric Company, represented by W. L. R. Emmet, consulting engineer. T. H. Soren, vice-president of the Hartford company, represents the latter organization in the application of the mercury boiler and turbine to generating-plant service.

Ford to Reconsider Bid

Government Asks Him to Make New Proposal for Muscle Shoals with Gorgas Plant Eliminated

HENRY FORD has taken under consideration a suggestion by Secretary of War Weeks that he amend his bid for a long-term lease of the Muscle Shoals hydro-electric project so as to eliminate from this offer the bid for acquisition of the Gorgas steam plant on the Warrior River.

Mr. Ford, accompanied by his son and engineers who have handled the negotiations for Muscle Shoals in his behalf, conferred on Sept. 6 with Secretary Weeks and also with President Coolidge. Other than that the suggestion would be taken under consideration, there was no formal statement indicating the attitude of the Detroit manufacturer.

The Alabama Power Company, acting under the terms of the contract between it and the federal government when the Gorgas steam plant was extended by the government during the war, has notified the War Department formally that it desires the government to vacate this property and has offered to pay $3,000,000 for that portion of the plant which was built by the government. By high officials of the administration this price is considered fair. The Alabama Power Company has extended the time within which the government must reply to its offer until Sept. 24. Secretary Weeks had asked for a delay until Nov. 1 to give Mr. Ford more time.

During the months of discussion in Congress regarding the disposition of Muscle Shoals, when the Ford offer attracted much attention, Mr. Ford declined on several occasions to amend his proposal so as to exclude the Gorgas plant. His desire evidently is to have an auxiliary steam plant where coal may be obtained the cheapest, and Gorgas is at the mouth of mines on the Warrior River. It has been pointed out, however, that coal could be floated down the Tennessee River to an auxiliary plant at Muscle Shoals itself at very low cost for transportation.

A New York newspaper quotes Secretary Weeks to the effect that even if the Detroit manufacturer were so to modify his proposal, the Secretary would not advise Congress to turn over the power project to him. Mr. Weeks is said to regard the $5,000,000 offered by Ford as a mere fraction of what the power project is worth, and under the new proposal that sum would shrink to less than half.

Pennsylvania Men for National Superpower

State Officials Co-operate in Power Development—Public Relations Actively Discussed—Technical Reports of High Quality—Attractive Entertainments

PUBLIC relations, superpower, current technical and commercial practices, together with entertainment features, occupied the attention of delegates and visitors at the annual meeting of the Pennsylvania Electric Association at Bedford Springs, Pa., on Sept. 5-8. The family reunion was held in an atmosphere of optimism and enthusiasm over electrical prospects in Pennsylvania which bad weather did not damp.

In addition to the reports of the technical and commercial committees, several things stood out which testified the splendid conditions existing in the state and showed the broad perspective with which future developments are being planned. The national viewpoint on superpower found favor, and encouraging and able addresses were given by Philip P. Wells, Deputy Attorney-General of the state; William B. D. Ainey, chairman of the State Public Utilities Commission, and F. Herbert Snow, the chief of the engineering bureau of the commission.

These men clearly outlined local and national issues and the part the utilities should play in their solution. In a remarkably co-operative and appreciative spirit and speaking in their public capacity, they called upon the utilities for aid in securing for the state and nation better political, social and financial conditions. They emphasized the fact that in Pennsylvania the utilities and the state administration are working hand in hand to bring about better conditions for the public and for the utilities.

Chairman Ainey said that personal honesty and the personal consciousness of moral responsibility are the essential things needed to secure progress in local and national affairs. Legal decisions and legislative enactments in themselves, he said, are unhelpful props unless supported by individual rectitude.

Commission to Make Own Survey

Chief Engineer Snow outlined the great future in store for the utilities in Pennsylvania and told the utility representatives that this future could be more quickly realized by inducing all concerned to work co-operatively. He asserted that the development of natural resources is a question extending beyond the boundaries of any one state. As a direct aid to the development of the electrical resources of Pennsylvania he said that a survey is now being made under the direction of the commission in order to get accurate data for coordinating the power supply for the state. The first task will be to map the transmission lines in the state, the territories now covered by each property and the extensions of territory and lines planned for the near future. This study is not connected in any way with the water-power survey of the state which is being undertaken as the result of the recent legislative enactment. In the opinion of Mr. Snow, a state-wide power supply will make for greater standardization in the quality of service, more uniformity in rates and a greater degree of use of electric power.

Deputy Attorney-General Wells gave an unusually instructive talk on the mutual obligations and the individual obligations resting upon the state and the utilities in carrying out their contract. He accented the facts that the contract of agency leaves no room for hostility on the part of either the public or the utilities and that in order to carry on their business with best success the utilities should explain clearly their activities to the public. In his opinion, simplification in rate schedules will aid in bringing about better relations. Part of Mr. Wells' remarks are printed on the opposite page.

Public Relations Activities

The good public relations already so notable in Pennsylvania can, utility men hold, be made still better, and a great deal of interest and enthusiasm was aroused by the addresses and reports dealing with the subject. President H. H. Ganzer said that the utilities should never forget that the public is the real boss and is entitled to good service. He stated that there is increased necessity for educating the public concerning the utility business because of the hold superpower has gained on popular imagination. This development will not pass unheeded by the people or by the politicians, and it has become incumbent upon the utilities to educate the people in the matter in order to bring about a constructive development of the plan. He also declared that simplified rate schedules, simplified bills, wider publicity of facts about the business and the individual acknowledgment of every utility representative of his duty to help educate the public are matters where great improvement can be made. He advocated a greater degree of co-operation and activity in public relations work.

E. L. Smith, chairman of the Public Relations Section, said that more active interest on the part of utility executives would help in public relations work. Committees can only plan and the actual work must be done by the member companies.

Miss Clara Zillessen, in reporting for the women's public information committee, said that besides knowing her job thoroughly, every woman employee should be grounded in simple electrical knowledge such as meter reading, cost of lighting and the elements of illumination, generation and transmission, also a general knowledge of the practices and policies of the company.

In the Commercial Section public relations as influenced by the servicing of new customers were vividly portrayed by a two-act play staged by W. J. Edmunds, the chairman of the sub-committee, and one assistant. They showed with real histrionic talent a good and a bad way of handling a new customer applying for service.

An able address was given by E. A. Hirschman, secretary of the York Chamber of Commerce. He told the utility men how they appear to the outsider and said they should explain their business more clearly to the public. He then depicted the public to the audience by taking types and dwelling on individual psychology. Thus he showed that the public is a large number of individual units each of which must be treated differently.

Major J. S. S. Richardson, director of the Public Service Information Bureau, told of the bureau work and of the opportunity for general publicity activities. He stated that in one year a noticeable improvement had been made.

Walter H. Johnson, president of the National Electric Light Association, pictured clearly to the audience the magnitude and complexity of the electrical industry and showed the rapidity of its growth. He told of the work the utility leaders have done in guiding the industry along proper lines and how the N. E. L. A. and its committees are working earnestly on plans for still greater accomplishments.

Technical Reports Valuable

The technical committee reports were all well prepared and contained data of value and interest. Some of the reports should prove of national interest while others dealt with conditions local to Pennsylvania. The burning of anthracite coal by central stations was thoroughly covered in the report of the prime-movers committee. The report and the discussion that followed showed that high volatile content and uniformity in size are primary considerations in successful firing. Culm or No. 4 buckwheat has promise as a cheap fuel if a process of sizing, a suitable grate, a pulverizing system or a mixture system using some bituminous coal or oil can be developed for practical and economical use. The chief trouble with anthracite firing, it was asserted, arises from the necessity of keeping a thin bed of fuel on the grates and the inability to secure rapid forcing.

R. M. Riegel gave a thoughtful paper on the economics of adding supplementary hydro-electric plants or steam extensions to an existing steam system. He showed by graphs the limitations under which it would be more profitable to develop hydraulic sites. For the assumed conditions and with load factor the variable, the author showed an equality in cost of installation at a 28 per cent load factor and a higher cost for the hydro-electric plant for load factors exceeding this percentage.

Probably one of the most valuable papers was presented by Henry Muller,

chairman of the underground systems committee. This paper was prepared for the benefit of smaller utilities which contemplated changing to an underground system or were faced with the question of deciding upon its possibilities and costs. Costs and arguments pro and con and a great amount of valuable data were assembled. The paper will be particularly valuable for the utility executive who is called before a council on a few hours' notice to tell why he should not put his system underground.

The wooden-pole situation in Pennsylvania gave rise to an animated discussion under the stimulus of a splendid paper on the subject presented by G. S. Van Antwerp. Chestnut poles have heretofore predominated in the region, but they are now scarce because of a general blight. A trend toward the use of Western cedars was exhibited, although some questions as to the suitability of the Southern pine were raised. Most of those present eliminated the Southern pine on account of the repugnance of linemen to climb it and were of the opinion that it was unsuitable for use in city streets because of the exuding creosote. The opinion was expressed by Thomas Sproul that poles were too highly classified and that all poles should be classified only on a strength and butt-circumference basis.

The inductive-co-ordination committee, of which M. E. Skinner is chairman, discussed several specific cases of co-ordination and treated fully a paper by R. W. Wilbraham entitled "Notes on Field Practices as Relating to Co-ordination Problems." The author recounted the essential data to be obtained in determining a line-building program and illustrated his general statements by typical cases.

A feature of the report of the electrical apparatus committee, R. A. Hentz chairman, was a description of the Barbados Island plant of the Counties Gas & Electric Company. This island station was designed for simplicity and economy in operation.

Commercial Policies Outlined

The commercial aspects of the utility business in the state were well treated in a series of reports of the Commercial Section committees. An excellent paper on new-business policies was given by M. C. Huse. The author discussed the commercial aspects of a system as a whole and said that, broadly, two fundamental factors should be considered in connection with new business. The first was a choice of locality where spare capacity exists or can be installed most economically; the second was the effect of the new business on the general system. Points to consider, he said, are load factor, power factor, voltage regulation, investment per kilowatt of additional business and revenue per kilowatt of maximum demand. The effect of business cycles should also be carefully considered when taking on new load. The author then outlined the splendid type of new business that could be obtained by adding to the number of wired homes along existing distribution lines. He said that, despite a fairly efficient sales campaign, there was room for an increase of 50 per cent per customer in residential consumption in Philadelphia. The existing consumption is 360 kw.-hr. per customer, as compared with 275 kw.-hr. a few years ago.

A store-lighting demonstration was well received, and papers were presented and discussed on vehicles, training of salesmen and other commercial activities.

Entertainment Features

The entertainment committee provided an unusually fine program for the delegates and the ladies. Golf, tennis, swimming, cards, motion pictures and dancing occurred as usual, and an added feature was an outdoor dance with special illumination and vaudeville entertainment.

The officers elected are: President, J. H. Shearer; first vice-president, G. M. Gadsby; second vice-president, W. E. Long; treasurer, P. J. Morrissey. J. Cox Thompson, P. H. Chase and E. C. Stone were elected to serve two years on the executive committee. More than seven hundred delegates registered.

Water-Power Act Charter of Liberty, Says Wells

Declaring that the public has been led to expect great things from the electrical utilities and has become convinced that the superpower systems mean much in its affairs, Philip P. Wells, Deputy Attorney-General of Pennsylvania and a member of Governor Pinchot's Power Board, speaking before the convention of the Pennsylvania Electric Association at Bedford Springs last week, went on to say: "I wonder whether you gentlemen realize the expectations you have raised among the people. The great men of your industry — engineers and managers — have prophesied a new economic era, have announced that it is now at hand. You have induced the rest of us to believe that you can and will do for power what the railroad did for goods in the last century, that is, bring it to every man's door in any desired quantity, of standard quality, and at prices substantially uniform for the same class of service. That is a large order, but we mean to hold you to your promise that you will fill it. If you fail, we shall not cease to expect it and will look for another agent to do it for us. It is up to you and to us to see that it is done. I have confidence in your success. The administration is preparing to help you through the 'Giant Power Survey,' and it asks you to be ready to help that enterprise. We see this thing bigger than any company's exclusive territory, yes bigger than any single state, and yet serving every hamlet and nearly every farm. We believe that you will bring in a new economic era and will transform the social life of our people. We desire to help you and we ask you to see this thing as big as your biggest men have pictured it and to help us in making their prophecy come true.

"As you know, we are basing our state policy on the federal water-power act and are trying to harmonize our state laws and administration with its principles. We have secured the co-operation of some fifteen states for its defense in the Supreme Court of the United States in the suit brought by the State of New York to annul the act. The declared purpose of the State of New York to monopolize for herself the use of the power of navigable waters of the United States upon and within her boundaries, to the exclusion of Pennsylvania and New England, is proof enough, if proof were needed, that the federal water-power act is a charter of liberties for the power industry of Pennsylvania. As such it deserves your support."

Cost of Coal to Operators Put at $1.20 to $2.80 a Ton

The agreement for the resumption of work at the anthracite-coal mines brought about through the mediation of Governor Pinchot of Pennsylvania will shift public interest again in part to the conditions underlying soft-coal mining. The government's fact-finding commission has just reported to the President that the cost of a ton of bituminous coal to a mine operator ranges between $1.20 and $2.80. The cost study was based on statistics from 266 mines in four states and covered operations in 1918, which was selected because conditions throughout that year were considered approximately uniform.

The commission has declared that the national interest requires the establishment of a fixed code for the settlement of industrial disputes.

St. Lawrence Waterway Plan to Come Before Congress

In the hope of favorable action from Canada within the next six months, plans for influencing Congress to get behind the Great Lakes-St. Lawrence Waterway project were revised last week at a meeting in Chicago of the Council of States of the Great Lakes-St. Lawrence Tidewater Association.

The election of Sir Adam Beck by an overwhelming majority to the Ontario Legislature on a hydro platform made leaders in the waterway project feel confident that Ontario will soon take a definite step in favor of the plan.

It was pointd out that the development of power along the proposed waterway route in Ontario rests entirely in the hands of the officials of that province, though the navigation of the river is controlled by the Dominion government at Ottawa. Sentiment in New England is rapidly changing in favor of the deep waterway, H. C. Gardner, president of the association, declared.

Four Commissioners at Swampscott Meeting

Reports of Progress in Public Relations, Commercial Developments and Engineering Mark the Annual Convention of New England N. E. L. A.

HEARTENING addresses by four public utility commissioners, accounts of gratifying progress in accident prevention and customer ownership, evidence of a broadening outlook upon commercial problems and reports of noteworthy advances in engineering and accounting were features of the fifteenth annual convention of the New England Division of the National Electric Light Association, attended by 450 members and guests, on Sept. 5 to Sept. 7, at the New Ocean House, Swampscott, Mass.

The commissioners who attended were C. C. Elwell of Connecticut, H. C. Attwill of Massachusetts, T. W. D. Worthen of New Hampshire and Samuel E. Hudson of Rhode Island. Each voiced sympathetic appreciation of the problems of the modern public utility, and their addresses contained a number of helpful suggestions to executives and their subordinates. Among these suggestions was Mr. Elwell's recommendation that poor-mannered applicants for utility positions be rejected, that rest and comfort facilities be provided for customers in central-station offices, that the higher executives of utilities keep open hours at announced regular times for customers and others, and that high-school classes be invited to visit plants and offices. The policy of "telling it to the public and telling it first" was urged by Mr. Hudson, who advocated informing the press and municipal authorities of all proposed rate changes whenever they were filed with a commission.

PUBLIC RELATIONS SESSIONS

Two public relations sessions were held, the convention beginning and ending in this way. H. P. Gifford, treasurer Salem (Mass.) Five Cents Savings Bank, outlined the growing interest of savings-bank officials in public utility bonds and urged the balancing of stock and bond issues to enable these banks to invest more largely in this field. H. A. Lemmon, Stone & Webster, Boston, gave an inimitable talk upon "How Bill Jones, Mr. Average Voter, Indicts the Public Utility," and W. W. Freeman, president Cincinnati Gas & Electric Company, outlined the fundamentals of public relations. M. H. Aylesworth, executive manager N. E. L. A., pictured the necessities of farm electrification, the progess of superpower, despite the obstructive attitude of such states as Maine, and the growth of good feeling toward utilities on the part of customer-owners and the general public. E. L. Milliken, chairman of the New England Public Relations Section, presided at both sessions.

President Barrows' address emphasized the importance of continuing the divisional taxation committee, the growth of better public relations and absence of trade secrets within the electrical industry. The membership committee, J. J. Buckley chairman, pointed to 1,528 members on the divisional list and showed how the year's work had been along the line of attaining "quality" membership rather than mere numbers.

THE MERCHANDISING PROBLEM

An unusual feature of the commercial sessions was a prepared discussion of the policy of "To Merchandise or Not to Merchandise?" for the central station. H. E. Duren, Greenfield, Mass., contended that better public relations, more active co-operation by contractor-dealers, broader trade prosperity and more efficient commercial service to customers result from the non-merchandising policy. E. S. Hamblen, Franklin, Mass., and A. B. Lisle, Providence, R. I., presented vigorous arguments in favor of appliance retailing, the latter citing figures to show that nothing like the sales volume attained by central-station effort would have been had without it.

F. M. Feiker, Society for Electrical Development, New York, gave an inspiriting address upon the place of electricity in cutting the costs of modern business and industry. He outlined the benefits of applying nationally measured ideas to local problems. Miss Alice Carroll of the society emphasized the importance of getting the housewife's viewpoint in appliance sales and servicing. H. N. Brown, New England Bakers' Association, Worcester, Mass., gave a brief but well-timed address upon the possibilities of co-operation between the electrical and baking industries. The Merchandising Bureau report was read by Cyrus Barnes, chairman.

V. M. F. Tallman, chairman National Power Bureau, urged executives to place more responsibility upon power engineers and challenged the latter to fit themselves for broader work. Several speakers cited recent advances in industrial electric heating which had resulted in marked improvements in the quality of products.

Features of the afternoon session Thursday were addresses upon lighting by J. Daniels, Boston; A. L. Powell, Harrison, N. J.; C. A. B. Halvorson, Lynn, Mass.; D. H. Tuck, Holophane Company, and W. D. Gorman, Hartford, Conn. R. S. Hale outlined the benefits of recent authorized changes in the National Electrical Code; N. T. Wilcox, chairman National Commercial Section, voiced the value of central-station merchandising along sound lines; H. Corning, Bangor, Me., spoke briefly on behalf of the Rate Bureau, and E. S. Mansfield and A. L. Kebbe touched respectively upon recent advances in electric transportation and in new-business work. Edgar J. Rich of the Boston bar gave a scholarly address upon the conflict of law and economics in rate making.

TECHNICAL PAPERS

At the technical sessions, S. B. Swan chairman, a comprehensive paper upon "The Possibilities of the Future Cable" was presented by S. J. Rosch and E. F. Reid, National Conduit & Cable Company, New York. In this paper many data were given upon current problems in advanced cable design and testing. C. A. Powel, Westinghouse Electric & Manufacturing Company, read an instructive paper on "Relaying Interconnected Systems," and Henry Schroeder, General Electric Company, gave a thorough chronology of the incandescent lamp. I. E. Moultrop and J. Pope, Boston, discussed the engineering features of the new Boston Edison Weymouth station, which have already been described in the ELECTRICAL WORLD.

A protracted accounting session was held Friday afternoon under I. S. Hall, chairman, with reports of the merchandising and jobbing committee by P. M. Scott, transportation accounting by J. F. Lyons, credits and collections by W. D. Dyer and preservation of records by J. H. Bissel, the respective committee chairmen. Abstracts of papers, reports and discussions of general interest will be presented topically in later issues.

High-Tension Conference

International Gathering to Discuss Trunk-Line Voltage Will Meet at Paris on Nov. 27

THE second international conference on electrical superpower systems will be held in Paris this year from Nov. 27 to Dec. 1, according to an announcement recently made by M. J. Tribot-Laspière, general secretary of the Union des Syndicats de l'Electricité. This conference has been considered desirable because the exchange of opinions, personal contact and other benefits which were afforded by the first conference in Paris, in 1921, when twelve countries were represented and more than two hundred delegates were present, proved very useful. As before, the purpose of the conference will be to discuss any timely subjects connected with the design, construction and operation of trunk lines which are to be operated at high voltages. Already the general secretary in Paris has been definitely advised of a number of technical reports that will be submitted.

The American Institute of Electrical Engineers has been asked to appoint delegates to the conference and to state what reports if any will be submitted. The matter has been referred to the United States committee of the conference. Of this committee Dr. C. O. Mailloux is the president and Dr. C. H. Sharp is secretary. The committee welcomes for consideration the names of any persons who could contribute to

the papers and discussions and who could make the trip to Paris incidental to a pleasure or business visit abroad. Consideration is now being given to the selection of the delegates.

Among the reports which are already scheduled for presentation by delegates from other countries than this are the following: Communication between central stations (Meyer); construction of high-voltage, high-capacity contact lines (Leboucher); construction of foundations for towers (Duval and Lavanchy); technical regulation of high-tension lines (Meyer and La Fontaine); influence of discharge and nature of water on insulator tests (Sailly); construction of porcelain and porosity of insulators (Bertrand); equipment of a million-volt laboratory at Ivry-Port (Groutelle); protection of high-tension hydro-electric lines (Gillespie), and methods of measurement and protection in high-tension tests (Bellon).

PAPERS FROM UNITED STATES

American contributions announced so far will include: American practice in outdoor substations (Young); the latest progress in insulation (Jackson); choice of voltage for high-tension lines (Hanker); latest progress in oil circuit-breaker development (MacNeill); relay protection for large high-voltage networks (De Jong), and insulators for high-tension lines (Bennett).

Four-Million-Dollar Electrification for Boston

Electrification of the Shawmut branch of the New York, New Haven & Hartford Railroad in conjunction with an extension of the Dorchester tunnel of the Boston Elevated Railway system south of Andrew Square will shortly be started as a result of the acceptance this week by the Boston City Council of an act of the last Legislature providing for this improvement. By this development it will be possible to operate rapid-transit trains from the Milton district into the heart of the city. The estimated cost is $4,000,000.

Pennsylvania Utility Plans Bonds for $50,000,000

Stockholders of the Pennsylvania Water & Power Company are to meet on Oct. 30 to vote on issuing $50,000,000 first refunding 5 per cent bonds for retiring $11,878,000 bonds outstanding and for future additions to facilities. The proposed issue is thought to be bound up with the plans to build a great hydro-electric plant on the Susquehanna River near Conowingo, Md. These plans are fathered by the Susquehanna Power Company, which holds a preliminary permit from the Federal Power Commission to construct a dam extending to the tailrace of the Holtwood power dam at McCall's Ferry. An ultimate output of 360,000 hp. at Conowingo is contemplated at a cost of $30,000,000.

Another Utility Bureau

Oregon Organizes a Committee to Spread Information, with F. T. Griffith at Head

OREGON is the latest state to organize a body for dissemination of facts and figures concerning its public utilities. The Oregon Public Utility Information Bureau was organized last week with Franklin T. Griffith, president Portland Railway, Light & Power Company, as chairman, and John A. Laing, vice-president Pacific Power & Light Company, as secretary-treasurer. The other members are C. M. Brewer, vice-president and general manager Mountain States Power Company, Albany; J. P. Lottridge, vice-president and general manager Eastern Oregon Light & Power Company, Baker; Paul B. McKee, vice-president and general manager California Oregon Power Company, Medford; Guy W. Talbot, president Portland Gas & Coke Company, and L. T. Merwin, vice-president and general manager Northwestern Electric Company, Portland. The seven utility companies represented are among the largest in the state, with an invested capital of about $125,000,000. They serve two hundred thousand customers with light, power, heat and gas.

This committee has selected as director of the bureau W. P. Strandborg, for the past eight and one-half years in charge of the publicity and advertising department of the Portland Railway, Light & Power Company. The headquarters of the bureau will be Suite 820, Electric Building, Portland.

The Oregon committee is the thirtieth to be formed, and several of those in existence cover more than one state.

New Project for Development on Green River

Early development of hydro-electric power on the Green River in Utah is possibly foreshadowed in an application filed with the State Engineer for a permit for a combined power and irrigation project at the so-called Split Mountain site near Vernal. This new project is understood to be backed by Col. A. E. Humphreys, a capitalist of Denver. On account of new features involved it is believed that the proposal eventually will be turned over to the Federal Power Commission for action and that it will be necessary for a license to be obtained from that body.

The Utah Power & Light Company has filed an application for a preliminary permit for a comprehensive project which includes a unit of development at the Split Mountain site. In all probability this company would not be ready to develop this particular site for a number of years, because the market conditions for power would not justify an early development, so if the backers of the new project are prepared to construct in the near future the high dam they contemplate, they undoubtedly would receive serious consideration from the commission. It would be necessary to create a market for power developed at the Split Mountain site, or at least for a large part of it, which probably would mean that an electrochemical or electrometallurgical industry would be brought into the region as a consumer.

Edison Illuminating Companies Meet Next Week

Meeting at Dixville Notch, N. H., on Sept. 18 to Sept. 22, the Association of Edison Illuminating Companies will carry out a technical program along the customary lines. Besides the committee reports, there will be prepared and impromptu discussion on reserve capacity, standardization of voltage and frequency, and operating troubles. Addresses will be made by Eugene McAuliffe on "The Bituminous Coal Situation in 1930," by Dr. Charles A. Eaton on "Industry and the Man," and by E. W. Rice, Jr., and W. L. R. Emmet. The application of full automatic substations to the Edison system at Kansas City will be discussed by H. C. Blackwell and A. E. Bettis, high-voltage cables by D. W. Roper, high-voltage practice by G. Faccioli, centralized supervision and control of power systems by R. J. Wensley, power transmission at high voltage by F. C. Hanker, and residence rates by D. C. Jackson. A masked ball is to be held, and entertainment will be provided as usual for the delegates and ladies accompanying them.

Wyoming Oil-Refining Company Plans Electrification

Plans have been completed for the construction of a ten-million-dollar electrification project by the Midwest Refining Company in the heart of the famous Salt Creek oil field of Wyoming. The power station will be at Shannon, 6 miles north of the Salt Creek fields. The plan was adopted after a voluminous study and report by A. W. Peake, general superintendent for the company, and after officials of the Midwest Refining organization had become convinced that the field will cease to be a flowing district in two years and will become entirely dependent upon pumps. Mr. Peake's estimates show that a great saving will be effected by substituting electricity for steam power in both pumping and drilling operations. When completed, the Salt Creek field, it is said, will be the largest electrically operated oil field in the world.

Electricity will be derived from a superpower steam-turbine plant. Fuel for the boilers will be natural gas from the wells in the field. One of the first steps in the huge project will be to impound behind a dam 900 ft. long, 40 ft. high and from 100 ft. to 200 ft. wide at the base, the floodwaters of Salt Creek. The present water supply is scant and injurious to the boilers.

Advocate Public Ownership

Meeting at Toronto, League Members Attack Private Companies and Praise Ontario Hydro

ONE hundred delegates from all over the United States attended the convention of the Public Ownership League of America, which was held at the King Edward Hotel, in Toronto, this week, on Sept. 10, 11 and 12, under the presidency of Willis J. Spaulding, Commissioner of Public Works, Springfield, Ill.

President Spaulding declared that Ontario possesses the most successful publicly owned hydro-electric enterprise in the world. In Springfield, he said, without the advantage of water power, the commission was able to secure bituminous coal at $1.60 per ton and produce electricity at prices which compare very favorably with the cheapest rates in the Ontario Hydro-Electric system. He asserted that municipalities in the United States are beginning to realize that they will have to act quickly if they are not to find themselves permanently under the control of large private syndicates operating public utilities. In Illinois the private electrical corporations are linking up scattered producing stations with a view to creating state-wide and even larger distributing systems. As a result it is becoming increasingly difficult, Mr. Spaulding said, for cities to launch their own publicly owned light and power systems. "We hope to be able," he concluded, "to take preliminary steps toward securing federal legislation which will enable us in the United States to link up numbers of cities and municipalities into state-wide or province-wide systems such as are in operation in Ontario."

SENATOR JOSEPH ATTACKS GENERAL ELECTRIC

Senator George W. Joseph of Oregon attacked the General Electric Company as responsible for throttling public ownership and hydro-electric development in Oregon. Although Oregon is the third state in the Union in potential energy, which is in excess of 6,000,000 hp., he said, there is less than 200,000 hp. developed. The Senator took the ground that the water powers of Oregon should be developed for the people in the same manner as Niagara and other provincial powers had been developed for the people of Ontario.

The secretary of the league, Carl D. Thompson of Chicago, spoke on "Superpower the Supreme Issue." He quoted extensively from United States papers and periodicals in an endeavor to show that private enterprise is quickly getting control of the great water-power resources of the States.

On Monday evening the convention was addressed by Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, who declared that Canada in general and Ontario in particular would oppose with all possible strength any increased diversion of the waters of the Great Lakes at Chicago through the Drainage Canal, which carries the sewage of that city to the Mississippi valley.

Other addresses were by E. W. Bemis on "Utility Appraisals" and Cornelius Sheehan of New York City, Deputy Commissioner of Water Supply, Gas and Electricity, on "Failure of Regulation in New York." Mr. Sheehan's paper dealt with the subway traction situation.

Manufacturing Companies Get Further Word from Japan

The International Western Electric Company has received a cable from P. K. Condict, vice-president of the company, anxiety about whose safety in the Japanese disaster was reported in these columns last week, saying that he is safe and uninjured at Osaka. The cable was filed on Sept. 5 and received in New York on Sept. 8. Mr. Condict reported also the safety of Kunihito Iwadare, managing director of the Nippon Electric Company, an associated company of the International Western Electric, and of Dr. Oi, director of the Nippon company. The death of Walter T. Blume was confirmed, but Mrs. Blume and her infant are safe. Robert F. Ashbaugh and Stanley Bracken, members of the engineering staff of the Western Electric Company at Chicago, who were in Japan, are reported safe at Kobe.

Mr. Condict cabled that the modern concrete buildings of the Nippon Electric Company were destroyed but that the older brick buildings are intact. The concrete structures were built under rigid specifications especially to withstand earthquakes. About one hundred persons were killed in the collapse.

A cablegram from I. F. Baker, manager of the Westinghouse Electric International Company at Tokio, confirms the previous Shanghai dispatch regarding the safety of four Westinghouse men in the danger zone. Besides Mr. Baker these men are C. A. Johnson, general engineer; R. D. McManigal, railway engineer, and John J. Mylin, service representative. Mr. Baker has been in Japan three years.

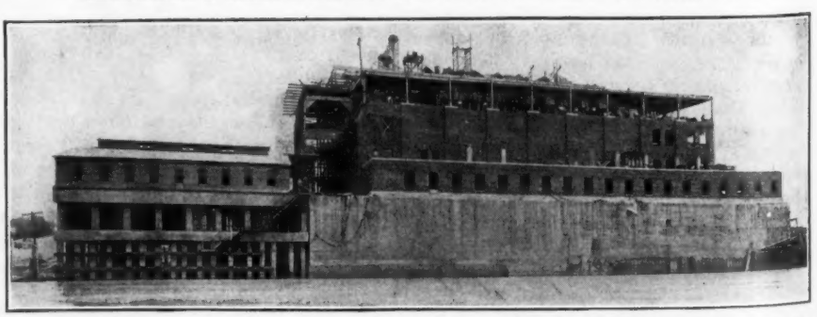
Despite contradictory cablegrams, the General Electric Company feels assured that all its American representatives, with possibly one exception, are safe and are either at Kobe or on the ocean on the way home. The possible exception is Mr. Amrine, whom a press dispatch has included, with his wife and child, as among the killed. The company's laboratory building at Kawafaki, half way between Tokio and Yokohama, was destroyed with total casualties of about seventy in killed and injured, including prominent native engineers and department heads. No word has come from the Shibaura Engineering Works, in which the General Electric Company is interested, and they may or may not be standing.

San Francisco Supervisors Are for Municipal Distribution

Unqualified indorsement of municipal ownership and the direct distribution of Hetch Hetchy power was given in a resolution passed by the Board of Supervisors of San Francisco at a special meeting held Sept. 11 to settle the question of the disposition of the electrical energy which will be available upon the completion of the city's 70,000-kw. Moccasin Creek power plant. The resolution expressed unalterable opposition to the sale of power through any private corporation and declared municipal distribution direct to consumers to be the basic policy of the city.

It further provided that steps be taken at once for the purchase of a distribution system within the city limits, preferably that of the Pacific Gas & Electric Company. The City Engineer is directed to complete the Moccasin Creek power house and build a transmission system to a point within the city limits without delay and to proceed forthwith with the preparation of plans and specifications for a complete municipal distribution system capable of supplying the city, the householders and the industries of San Francisco with electrical energy.

Cahokia Plant at End of a Year's Construction



THE above illustration shows the state of construction last month of the first of the four contemplated sections of the Cahokia plant of the Union Electric Light & Power Company of St. Louis, on the Illinois bank of the Mississippi south of Free Bridge. The ultimate capacity of this plant will be 320,000 hp., or three times the all-year rating of the plant at Keokuk Dam.

Rocky Mountain Division to Take Up Many Subjects

Meeting for its fourth annual convention in conjunction with the Colorado Public Service Association, which is to hold its twentieth, the Rocky Mountain Geographic Division of the National Electric Light Association will on Sept. 17 to Sept. 19, at the Hotel Colorado, Glenwood Springs, Col., carry out the following well-balanced program:

MONDAY, SEPT. 17

Morning.—Address, Retiring President J. F. Dostal, Colorado Springs; address of welcome, Mayor W. G. McDonald, Glenwood Springs; address, Ernest C. Stenger, president Colorado Public Service Association, Denver; address, D. C. McClure, president Rocky Mountain Division, N. E. L. A., Denver; "Timely Topics," C. N. Stannard, Denver; "Illuminating Engineering as an Asset to the Electrical Industry," George H. Stickney, Edison Lamp Works, Harrison, N. J.; "The Constitution and Reasonable Rates," Paul W. Lee, Fort Collins, Col.; "What the Electrical Co-operative League of Denver Has Accomplished," S. W. Bishop, Denver.

Afternoon.—Reports of wiring committee (S. W. Bishop), membership committee (George E. Lewis) and committee on relations with financial institutions (W. C. Sterne); "Generating Good Will," John W. De Maine, Minneapolis; "Public Utility Financing," James N. Wright, Denver; "Publicity and Advertising Activities of the N. E. L. A.," George F. Oxley.

Evening.—Address, "The American Constitution," John T. Barnett, Denver.

TUESDAY, SEPT. 18

Morning.—Report Public Relations Section, E. A. Phinney, Golden, Col.; report Accounting Section, J. E. Loiseau, Denver; report Technical Section, H. H. Kerr, Denver; "Purposeful Publicity," Horace M. Davis, Lincoln, Neb.; "Our Relations with Our Employees," Ben S. Read, Denver; "Public Utilities—History, Causes of Unpopularity, Menace of Municipal Ownership," Charles R. Brock, Denver; "Promotion of Electric Cookery," Mrs. Alma E. Hunt, Pueblo, Col.

Afternoon.—Report Commercial Section, E. H. Coe, Denver; reports of accident prevention committee (F. A. Tewksbury), company employees' organization committee (C. H. Elliott) and rural lines committee (Carl Luscombe); "The Relation of Protective Apparatus to Continuity of Service," E. E. F. Creighton, Schenectady, N. Y.; "Present-Day Problems," George A. Hughes, Chicago; "Customer Ownership of Public Utilities," W. H. Hodge, Chicago, discussion by V. L. Board, Denver.

WEDNESDAY, SEPT. 19

Morning.—"N. E. L. A. Activities," Executive Manager M. H. Aylesworth; "Future of Application of Electricity from Commercial Department Standard," E. A. Hawkins, New York; "Supervision of Public Utility Organizations," R. E. Burger, New York; "Activities of Rocky Mountain Committee on Public Utility Information," George E. Lewis, Denver.

Afternoon.—Business sessions; election of officers.

Pacific Coast Jobbers Meet in Oregon

The electrical jobbers of Portland, Ore., were the hosts at the quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association held at the New Gearhart Hotel, Gearhart, Ore., on Sept. 5-7. The attendance was well above the average so far as delegates from the Northwest were concerned, though from the more distant points it was somewhat less than usual.

Besides the business discussions at the closed sessions on Wednesday and Thursday afternoons, two papers were presented—one, entitled "My Competitors," by George A. Boring, Pacific States Electric Company, Portland, and the other, on the cost of sales solicitation, by Harry Byrne, North Coast Electric Company, Seattle. A. C. McMicken, commercial manager Portland Railway, Light & Power Company, was in the chair.

At the open session on Friday afternoon an address was given by John A. Laing, vice-president and general attorney Pacific Power & Light Company, Portland, on "State Ownership of Utilities." He was followed by Frank Branch Riley, who spoke of the importance of tourist trade. The banquet on Friday evening and the social features of the convention were very successful.

Brief News Notes

Next Week's McGraw-Hill Radio Talk.—H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*, will give a radio talk on Wednesday, Sept. 19, on "The Work of the Chemical Engineer." This will be the third of the radio talks to be given by editors of McGraw-Hill papers in September.

Kansas City, Kan., Asks $4,000,000 for Light and Water Departments.—An ordinance providing for a bond issue of $4,000,000 for the Kansas City (Kan.) light and water departments will probably be voted on at a special election soon. The money is to be used for extensions and improvements, and half will go to the lighting department.

American Gas & Electric Absorbs Charleston (W. Va.) Company.—The West Virginia Water & Electric Company of Charleston has been acquired by the American Gas & Electric Company of New York. The West Virginia company furnishes Kanawha City and Dunbar, W. Va., with electric service, as well as Charleston, and is completing an extension to Malden.

Portable Substations.—The first portable electric substation used by the Interstate Public Service Company was "hooked on" at Taylorsville, Ind., recently. The station, which is a 500-cycle plant, was built at the company's shops at Scottsburg. Other like plants will be built and put in use by the company. They can be transported from one station to another to supply additional power when needed.

General Electric Company Uses Airplane to Expedite Mail to Its Assembled Salesmen.—Morning papers and important mail were delivered by airplane to the two hundred members of the General Electric Company's sales conference at Camp Lovejoy, Association Island, Ontario, last week. The flight was made from Schenectady, 132 miles away, in about two hours.

Keokuk Power for Galesburg, Ill.—Power from the Keokuk dam will be brought to Galesburg within a year, according to predictions being made by officials of the Illinois Power & Light Company and the Sante Fé railroad. The transmission line will be built on the Santa Fé right-of-way and will cost approximately $750,000. It will run within four miles of Monmouth, and the line may be tapped to afford cheaper power to that city.

Monument to Alfred Noble.—The Alfred Noble Memorial Committee, which has in charge the erection of a suitable monument to that distinguished American engineer, who died in 1914, has selected a design for the fountain which it is the purpose to erect in Rawlins Square, Washington, at a cost of $100,000. An earnest request is made to engineers and members of allied professions to contribute to the fund being raised for this object. Robert Ridgway, 49 Lafayette Street, New York, is the treasurer.

Ornamental Substation for San Diego.—A new 6,000-kva. substation has recently been placed in operation by the San Diego Consolidated Gas & Electric Company. On account of its location in a semi-residental district special attention was given to the appearance of the building. The Spanish type of architecture was used, and the building is artistically decorated in keeping with the other structures in the vicinity. Vines and shrubs will beautify the structure and will serve to conceal the lighting units for night illumination.

Contracts for English Railroad Electrification.—In an item with reference to the pending electrification of the Southeastern & Chatham division of the Southern Railway in England printed in this column on July 28 it was stated that the railroad had accepted the offer of the Metropolitan-Vickers Electrical Company to build 508 electric motors and control gear. As a matter of fact, information comes, the contract for the supply of the electric motors was placed with the English Electric Company, the Metropolitan-Vickers Electrical Company being awarded the contract for the control gear.

Power Sites in Texas.—Plans for water-power development as well as flood control, reclamation and irrigation of land are involved in a topographic survey of Texas regions which was begun on Sept. 1 by engineers of the United States Geological Survey in co-operation with the State Water Board. The work will take two years. The Geological Survey plans to expend nearly $100,000 a year upon it, and the state will match this appropriation.

Further Extension of Louisville Plant Necessary.—Owing to the continued growth of its residential and industrial load a further extension of the Riverside plant of the Louisville Gas & Electric Company has become necessary, and it is planning to enlarge the boiler room at a cost of about $520,000, work to begin early in the winter. The horsepower to be added to the steam unit will be about 20,000, making a total of 120,000 hp. The company is now com-

pleting a two-and-a-half-million-dollar extension to its plant and has already installed a 20,000-kw. turbine. In order to make room for the proposed extension the plant office building will be razed.

Georgia Company to Rebuild Dam.—The Baker County Power Company, Newton, Ga., will soon begin work on rebuilding the dam across Notchaway Creek, which was washed out in January. The Mees & Mees Company of Charlotte, N. C., are the engineers in charge of the work. The cost of replacement will approximate one hundred thousand dollars.

Powers of Alabama Commission May Be Circumscribed.—A bill has been introduced in the Alabama Legislature to take away from the Alabama Public Service Commission the power to halt the extension of hydro-electric lines to all sections of Alabama. This measure would repeal the sections of the present law giving to the commission the authority to grant certificates of convenience and necessity to public utility companies which desire to extend their service. The bill was inspired, it is thought, by the action of the commission in denying permission to the Alabama Power Company to erect a transmission line from Huntsville to Muscle Shoals and to build a hydro-electric plant on the Warrior River at Lock 17.

West Penn's Charleroi Substation.—The new "super-substation" of the West Penn Power Company at Charleroi, Pa., one of the largest in the country, which is already in service, although only partly completed, is now the central point of the West Penn transmission and distribution system. Power from the company's generating plants at Springdale and Connellsville, Pa., and Beech Bottom, W. Va., is fed into this new station over steel-tower lines, and outgoing lines radiate to all points of the compass. When the plans are completed power can be fed into a common point at Charleroi and distributed to any desired point on the system. The substation will be an important factor in the economical operation of combined water-power and steam generating plants.

Hydro-Electric Plant with 3,000-Ft. Drop for Clark County, Nevada.—Nevada newspapers give particulars of a hydro-electric plant to be built at Indian Springs, 45 miles from Las Vegas, Nev., which will develop, according to former Deputy State Engineer Ira MacFarland, 5,000 hp. and supply power and light to Las Vegas and the adjacent territory in Clark County. Much of the power will be used for pumping water for irrigation. The water for the power plant, Mr. MacFarland is quoted as saying, comes from eleven springs in the Charleston Mountains, which will be brought to one point of contact at Indian Springs, 12 miles from the source, the total drop being 3,000 ft. A substation for distribution is to be built at Las Vegas, from which the supply to that town will be provided, and lines will also run to the gypsum and borax plants in that region.

Seattle Sticks to 26,000-Volt Distribution.—An effort made by the Electrical Craftsmen's Union of Seattle to have distribution at 33,000 volts substituted for the 26,000-volt system already adopted was defeated by the City Council recently at the instance of Superintendent J. D. Ross, who said such a change would necessitate two sets of transformers and eventually add $45,000,000 to the cost of Skagit River energy. "Seattle's distribution system," said Mr. Ross, "is the only one of its kind in the world. It is a modified form of one adopted here about fifteen years ago which during the intervening time has proved immensely superior in economy and service."

Radio Exhibit at Chemical Exposition.—How radio is finding a use for many of the rare metals will be shown at the composite radio exhibit at the National Exposition of Chemical Industries, which opens at the Grand Central Palace, New York, on Sept. 17. A number of well-known firms have contributed products of their manufacture which deal directly or indirectly with the construction or operation of radio instruments. Thorium, tellurium, selenium, tantalum, molybdenum — all metals rarely getting into commerce on a broad scale—will be demonstrated. In addition to the metals, carborundum crystals, synthetic resins, hard-rubber radio parts, extremely fine precision instruments for electrical work and a number of other important features of the radio constructions will be demonstrated. Alundum tubes for use in measuring high temperatures, particularly in furnaces for drawing tungsten tube wire, will also form part of the exhibit.

Springfield (Mass.) Company Repairs Fire Damage in Record Time.—A notable achievement was made by the United Electric Light Company of Springfield, Mass., in re-establishing its power circuit so that no West Springfield industry lost an hour's time as a result of the temporary disruption of the company's lighting and power service for that town when the North End bridge across the Connecticut River was destroyed by fire on Saturday afternoon, Sept. 8. The fire destroyed three street-lighting, two house-lighting and one power cable which ran underneath the wooden flooring of the bridge. As soon as it was possible to begin work cables were laid across the new Memorial Bridge and new wires spliced to the damaged cables. By night the power service was connected, and the industrial plants were enabled to reopen Monday morning as usual. By 10 o'clock Sunday morning one house-lighting circuit had been replaced and by late afternoon the second house-lighting service was connected. Monday night the street lights were restored. The work involved the rerouting of ten or twelve miles of circuits.

Associations and Societies

Big Attendance at Denver Meeting.—More than three thousand persons listened to Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, in the Denver municipal auditorium on Sept. 4, at a meeting held under the joint auspices of the Rocky Mountain Division of the N. E. L. A. and the Colorado Chapter of the A. I. E. E. The subject of Dr. Steinmetz' lecture was "The Electric Power Industry," and a special amplification system was installed in the auditorium for the occasion. Clare N. Stannard, vice-president of the Public Service Company of Colorado, was chairman. George H. Stickney of the General Electric Company will be the principal speaker at a meeting to be held in Denver on Sept. 20, under the auspices of the Electrical Co-operative League of that city, as a preliminary to lighting campaigns contemplated by the league.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Conference of Electrical Leagues—Association Island, Sept. 17-19. Society for Electrical Development, New York.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Edison Illuminating Companies—Dixville Notch, N. H., Sept. 17-21. P. S. Millar, 84th St. and East End Ave., New York.

Michigan Electric Light Association—Grand Rapids, Sept. 18-20. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

International Association of Municipal Electricians—Reading, Pa., Sept. 25-28. C. R. George, Houston, Tex.

Great Lakes Division, N. E. L. A.—French Lick Springs, Sept. 26-29. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

National Safety Council—Buffalo, Oct. 1-5.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

Empire State Gas and Electric Association—Lake Placid, N. Y., Oct. 8-9. C. H. B. Chapin, Grand Central Terminal, New York.

Association of Electragists International—Washington, Oct. 8-13. Farquson Johnson, 15 West 37th St., New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 8-13. J. W. Welsh, 8 West 40th St., New York.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, 900 B. F. Keith Bldg., Cleveland.

Recent Court Decisions

Evidence as to Depreciation.—In an action brought by the Van Wert Gaslight Company against the Public Utilities Commission of Ohio, the Ohio Supreme Court declared that in proceedings by a public utilities commission to fix rates, dependent on the valuation of the property of a public utility, where the commission admitted all evidence offered by the company, including an inventory filed by the company, and also itself took an inventory and decided the rates on its own inventory, the court will not say as a matter of law that the order fixing the rates disregarded evidence as to depreciation. (140 N. E. 137.)*

Constitutionality of North Dakota Utilities Acts Sustained.—The legislative acts conferring upon the State Board of Railroad Commissioners of North Dakota the power to regulate rates and practices of public utilities have been declared valid in a decision handed down by the State Supreme Court in an action brought by the Hughes Electric Company of Bismarck for an injunction to prevent the commission from holding a hearing affecting rates for electricity and steam heating. The plaintiff maintained that the law was void as vesting legislative or judicial powers in administrative officers.

Commission May Regulate Rates of Corporation Not a Public Utility Where These Involve Contract Rates of a Utility.—The Ohio Mining Company and others made complaint before the Public Utilities Commission against the rates for electricity of the Hocking Power Company, the Athens Electric Company and the Southern Ohio Power Company. The Athens Electric Company and the Hocking Power Company filed answers denying that the rates were unreasonable and unlawful. The Southern Ohio Power Company filed a motion in which it asked that it be dismissed from the action on the ground that it is not a utility within the meaning of the public utilities act of Ohio since it disposes of its entire stock of electrical energy by private contract to the other two companies, whose stock it owns. The latter plea was accepted by the commission, and the dispute was carried to the Ohio Supreme Court, which has reversed the finding and sent the case back to the commission. The court held that, although the mere fact that a corporation sells its entire product upon contract to public utilities which in turn sell that product to consumers does not make such corporation a public utility within the definition of the law, where, by the process of incorporation, the ownership of a property is nominally divided between two or more corporations, but is in fact the same, and the business of such corporations is but a single enterprise, a dedication of the property of a nominal owner thereof to the public service is attributable to the real owner thereof and is a dedication of the entire property involved in the common enterprise. (140 N. E. 143.)

Rules of Procedure in Public Service Commission Cases in Indiana Courts.—In City of New Albany vs. Public Service Commission of Indiana, a case in which complaint was made of gas rates fixed by the commission, the Supreme Court of Indiana ruled that under the special statute affecting court procedure in commission cases strict rules of pleading under the Civil Code did not control, and that by supplemental complaint facts occurring after the suit was begun could be brought in. (140 N. E. 433.)

Criticism of the Reproduction-Cost Theory of Valuation.—In upholding the Wisconsin Railroad Commission against the Waukesha Gas & Electric Company, which appealed from the commission's decision refusing it an increase of rates, the Supreme Court of Wisconsin said that no court could interfere with a rate made by the commission on any ground except that it was unreasonably high or unreasonably low; that in Wisconsin where a utility operated under an indeterminate franchise in the nature of a monopoly, with an agreement that the municipality might take over the plant at any time at a fair valuation, the property of such utility could not at any time be of greater value than that which the municipality might purchase; that such value was the value of the plant of the utility as a whole for the purpose of supplying the public with its commodity at a price regulated by law. The court discussed the weight to be given to reproduction cost new less depreciation in arriving at a valuation, concluding that: "It is the property that the constitution affords protection and not any special theory of valuation. . . . The theory of cost of reproduction new less depreciation is unsound for the reason that cost of reproduction can only be established theoretically. Every-day experience in structures about to be erected confirms this. When applied to property of a public utility purchased under conditions which no longer exist and incorporated into the property of the utility under circumstances that cannot be reproduced, it is not only theoretical but highly speculative. If the cost of reproduction is to be given special weight when prices rise, it must be accorded the same value when they drop. . . . Materials entering into the construction of a plant of a public utility lose their individual identity and become part of a whole to be valued as a plant and not as materials not so incorporated."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Commission Should Not Interfere in Questions of Management.—In an appeal against the rates of the Lisbon Light & Power Company exception was taken to expenditures made by it for an oil engine and an extension. The New Hampshire Public Service Commission declared that such expenditures belonged to the realm of management, not that of supervision, and that they were not subject to interference by the commission, except possibly in cases where the cost was clearly unwarranted.

Depreciation of Overhead Expenses.—The Michigan Public Utilities Commission in its valuation of the property of the Detroit United Railway held that the theory of not depreciating overhead expenses is defensible only upon the hypothesis that the property is to be continuously maintained in operating condition from operating revenues and that no capital contributions are to be made thereto. The commission held that probably those overheads allocable to property whose maintenance is constantly paid from operating revenues and not charged to the capital account ought not to be depreciated as a matter of accounting practice. It was pointed out that the Interstate Commerce Commission depreciated certain overheads and that the Supreme Court of the United States in its review of the Galveston case did not hold that no overheads should be depreciated, although it was said that many items included in the overhead cost of original construction might properly be excluded in calculating the amount of the depreciation annuity.

Company Ordered to Connect Farmers at Actual Cost Because of Alleged Misrepresentation.—Complaint having been made that the Badger Public Service Company was attempting to charge farmers $200 each for connection with its lines, although, it was asserted, the company's representatives had before the line was built led the farmers to believe that the charge would not be more than $65, the Wisconsin Railroad Commission has ordered the company to connect farmers living directly along the transmission system at actual cost excluding the cost of metering equipment. The commission blamed the company for failing in this instance to apply the accepted rules of the commission for rural service, though previous to an actual determination the commission did not say that the charge of $200 was excessive. The farmers contended that a proportionate charge should be made against certain villages served from the line. They also asked that where three or four farmers live on adjacent land it be made possible for them to get energy from one transformer.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

C. S. Banghart Now Staten Islander

Charles S. Banghart, who was recently appointed vice-president of the Staten Island (N. Y.) Edison Company and the Richmond Light & Railroad Company, as was announced in the Sept. 8 issue of the ELECTRICAL WORLD, has been associated with the electrical industry since 1892, when he entered the employ of the Thomson-Houston Electric Company to electrify the street-railway system at Allentown, Pa. From that year until 1914, a period of twenty-two years, Mr. Banghart was engaged in railway work with the Union Railway Company of New York City, the Flushing & College Point (N. Y.) Lighting, Power & Railway Company, the Interstate Railway Company of Reading, Pa., and the New York & Queens County Railway Company, Long Island City, N. Y. In 1914 he went to Binghamton, N. Y., as vice-president and general manager of the railway and electric company there, remaining until 1919, when he went to Augusta, Ga., as general manager of the Augusta-Aiken Railway & Electric Corporation. It was this position Mr. Banghart relinquished to accept the appointment in Staten Island.

Mr. Banghart occupied an enviable position in Augusta both as a public utility executive who took charge of a badly run down property, built it up and restored public confidence and as a popular citizen who co-operated in every enterprise for the advancement of the city's interests. The properties on Staten Island are under the management of the J. G. White Management Corporation of New York City. R. L. Rand, formerly vice-president and manager of the Richmond Light & Railroad Company, will continue with the successor company as general manager.

Malcolm H. Hendee, commercial and purchasing agent of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., has been appointed assistant secretary and treasurer of the company to succeed F. Bayard Culley, recently made general manager. Mr. Hendee has been connected with the company since 1908.

Arthur Williams, general commercial manager of the New York Edison Company, returned from abroad last week on the Cunard liner *Aquitania*. Mr. Williams reports that American equipment and methods are being adopted in Europe and that that continent is turning more than ever before to electrical development. Judging from the tendency which is evident at present, he believes that in a short time every available source of water power in Europe will be utilized.

J. H. Shearer Heads Pennsylvania Electric Association

J. H. Shearer, vice-president in charge of operation of the Penn Central Light & Power Company, Altoona, was elected president of the Pennsylvania Electric Association at the convention which the association held last week at Bedford Springs. Mr. Shearer

J. H. SHEARER

entered the service of the Thomson-Houston Company in 1890 and after a short association with this organization and the Poulton Electric Company he went to Mexico with Rosenswag & Company, agents for the Westinghouse company in Mexico City. Subsequently he became identified with the Santa Gertrudio Jute Mill Company, Orisaba, then with the Cia de Luz y Fuerza Motiz, Guadalajara. Following service in the Spanish-American War, he joined the General Electric Company at Schenectady, but returned to Mexico shortly after to take charge of the Cia National de Luz Electrica. When a consolidation of all the electric utilities of Mexico City and surrounding territory was effected in 1903 he formed the construction firm of Gardner & Shearer. This partnership was dissolved in July, 1907, and in August he organized the Shearer Electric Construction Company, which continued in business until August, 1911, when, on account of the revolution in Mexico, he sold his interests and returned to the United States. From 1912 to 1914 he was with the Kelvin Engineering Company of New York City. Later he was made superintendent of the Eastern Shore Gas & Electric Company with headquarters at Salisbury, Md., which subsequently came under the management of Day & Zimmermann, Inc. In May, 1916, he was offered and accepted the position of general superintendent of the Penn Central Light & Power Company, also under the management of Day & Zimmermann, and early in 1923 he was elected vice-president in charge of operation, the office he occupies at the present time.

Prof. J. W. Miller, who has served as head of the department of electrical engineering of the Oklahoma Agricultural and Mechanical College for several years, is now mechanical and electrical research engineer at the engineering experiment station of the University of Arkansas. Mr. Miller will devote his time exclusively to research work on problems of interest to the industries of the state. He is a graduate of the University of Texas and of the Massachusetts Institute of Technology.

Obituary

John Braxton of Kokomo, Ind., one of the first promoters of the Indiana Railways & Light Company, later merged into the Northern Indiana Power Company, died suddenly at his home in that city. Mr. Braxton, who was seventy-nine years of age, took a prominent part in the early industrial development of Kokomo.

Henry W. Harris, associate editor of the *Stone & Webster Journal*, died suddenly upon the golf links at Marion, Mass., Sept. 9. Mr. Harris was born in 1871 at Flushing, L. I., and was graduated from Yale University in 1895. He entered the public utility industry about nine years ago and was on the staff of the Northern Texas Traction Company, Fort Worth, Tex., from 1914 to 1921. He went to the Boston office of Stone & Webster, Inc., about two years ago and for most of that time was engaged in editorial work.

Morton J. Fitch, sales manager of the motor division of the S. A. Woods Machine Company, Boston, and one of the best-known commercial engineers in the New England central-station and manufacturing fields, died Sept. 5. Mr. Fitch was born in Chicago in 1872. For twenty-eight years he was in the employ of the General Electric Company, with headquarters at the Lynn (Mass.) works. Several years ago he resigned to become associated with the Woods organization.

Langdon Gibson, who had been associated with the General Electric Company thirty-one years when he resigned two years ago because of ill health, died Sept. 5 at Criehaven, Me., where he was spending the summer. Death was due to cerebral hemorrhage. He was a native of Boston and was fifty-eight years of age. Mr. Gibson was production manager of the General Electric Company, Schenectady Works, at the time of his resignation and was well known in the industrial world.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

The High Cost of List-Price Changes

What These Mean to Catalog Costs—How List Price Changes Have Increased—Comparison with Other Industries a Troublesome Distribution Cost

NOT long ago a certain jobber of electrical supplies wrote a letter and sent it out to the important manufacturers of wiring devices. He said:

We are constantly annoyed by the great number of changes made in list prices from time to time, which it seems to me has become quite acute during the past six months. It just means that a concern getting out a catalog today will suffer because that catalog will become practically worthless inside of a year.

Prior to the period of the war there were comparatively few changes made in list prices, and during the height of the high prices we were told that adjustments would be necessary in order to meet the increased cost of manufacture. We find that since that time prices have changed several times. Let us take, for example, the pull socket, which changed from 60 to 50 cents, from 50 back to 60, and now has been reduced from 60 to 55.

We should like very much to get out a catalog within the next twelve months, but are thoroughly convinced that until the manufacturers have followed some definite plan of action in order to make a catalog worth while we certainly shall not go ahead with it. I think this is a detriment to a manufacturer who is anxious to have a jobber display his material in the jobber's catalog. I don't mean to infer that this applies only to your company. It applies to all manufacturers—of wiring devices in particular. In fact, I should like very much to get an expression from you as to what the jobbers may expect and the possibility of the changes being minimized in the future.

I realize that the manufacturer has his own problem, but it strikes me that there should be a way to meet this common problem by having a separate schedule for items which may be subject to radical changes that could be adjusted by a change in the discount rather than in the list price.

This letter describes a situation which apparently is becoming steadily more of an issue between the electrical jobbers and their suppliers. As it states, the condition applies particularly to the wiring-device lines, but this has come to be a very comprehensive term, until today the materials included within the group have come to bulk well near the three-fourths of the average jobber's stock and a very large proportion of his catalog and of his salesmen's time. Trouble in the wiring-device lines is therefore a very serious matter to the distributor of electrical supplies, and any waste and loss that affects him so extensively becomes a burden on the cost of electrical materials and the concern of the industry generally.

What Catalogs Cost

The average jobber's catalog represents an expenditure of from $4,000 to $10,000. These catalogs are printed and distributed at this heavy expense because they are considered by the trade and industry an essential service. Nowhere else can there be found in one book a complete list of the full variety of electrical supply lines, embracing the products of the many manufacturers. Dealers, contractors, industrial plants and central stations use these books in planning installation work, in selecting and specifying, in calculating costs and the ordinary routine of quoting and ordering. The price figures listed in these catalogs are the most vital feature in them. It is of the utmost importance, therefore, that these prices be correct and remain so as long as possible, for just as soon as the prices listed in the book become no longer correct and dependable then the book becomes useless. And by the book is meant the many catalogs of all the jobbers. Since there are about 500 jobbers of electrical supplies in the United States and probably one-fourth of them publish catalogs about every three or four years, we can conservatively estimate an annual expenditure of, say, $150,000 paid out perpetually, each year, for jobbers' catalogs.

These books are published every four years, understand, not because the lines change but because the prices change. New devices introduced and added to the jobber's line can be appended to the book by extra sheets. But when too many of the prices change the value of the book is gone. If it were possible to reduce the rapidity of list-price changes that affect this book, the life of a jobber's catalog might be greatly lengthened. And if it could be doubled, say, it would mean a saving of $75,000 or more a year in the expense of selling electrical supplies, and the entire industry will agree that this would be worth while.

But that is not the only expense that is caused by this constant changing of list prices. The theory of the list price and discount system is that by setting a high list men may become familiar with the base element in the cost of a commodity. One may learn the discount he receives and the other discount that he gives his customer, and when it becomes necessary to change the price, because of some fluctuation in a raw material, for instance, the discount may be changed, but the list is not changed. Such a change of prices at best entails a troublesome and expensive routine on the part of the jobber. The quotation check must be notified and he must change his price sheets. Salesmen must be notified and they must make the change in their price books. Notices are very often also sent to customers on important price changes, and for some time it becomes necessary to explain changes and meet objections. Consider how much more labor and expense is caused when in addition to unavoidable changes in discounts come list-price changes at frequent intervals?

How Lines Compare

The question is, Can it be avoided? Would it be possible to reduce the number of price changes, increase the life of catalogs and lighten the burden on personnel? Here are some interesting comparisons for which a number of prominent jobbers are authority:

On outlet boxes list prices have changed once in ten years.

On bushings and lock nuts there has been one change in ten years.

Cable boxes are very steady and so are elbows and canopies.

Fuses have changed list only once in ten years.

Fans change list infrequently.

Lamps have changed often, there being five or six changes in list price on one lamp, for example, in the last four or five years.

Heating devices, particularly flatirons, have changed often.

Porcelain sockets and receptacles, switch plates, push-button switches and several other devices have been changing list frequently. In addition, there are in fact three different lists on switch plates, covering thin, medium and thick plates, varied for two-gang, three-gang, four-gang and so on, whereas one thickness of plate would be enough, according to general opinion. These goods, together with plug cut-outs, fuse plugs, pull and key sockets, represent the bread and butter of the jobbing business. And it is upon these that the greatest number of list price changes has come.

Every day they say there come in from sources on all sides new lists of changes. One day recently one manufacturer alone announced 113 changes in list prices. In a large organization it takes the equivalent of the full time of one clerk to keep list-price schedules up to date. This constant change inevitably leads to a very large number of errors in quoting and in billing that occasion in the aggregate a heavy loss, and the influence of this instability in the very fundamental of cost knowledge —the memory of prices—entails an amount of mental anguish and exasperation that can be imagined.

If former history and the practice of other industries counts for anything, this present epidemic of list price changes is more of a habit than anything else, an outgrowth of the agitated years of the war and postwar periods. For formerly there were but few such changes. List prices carried on year after year with very little disturbance, and so, in fact, it is today in the hardware, mine supply and plumbing industries. The following summary statements by electrical jobbers who maintain departments selling in these fields is impressive evidence, it would seem, that list price stability can be maintained:

A Connecticut jobber says that he has complained so much against the evil that he has the reputation among manufacturers of being a "common kicker." He states that he is in favor of the manufacturer adopting a sufficiently high price so that it will stand. By doing this the manufacturer would be able to revise his discounts and take care of fluctuations in cost. He is of the opinion that list prices in the electrical industry are too low.

A West Virginia jobber states that he would like to see steps taken to remedy the evil that at present exists in the continual change of list prices. He states that his concern handles such articles as bolts, extras on rails, extras on steel, pipe fittings, belting and many goods of similar kinds on which one change in list price in five years would cover the average. He says there are many articles, like spring cotters, emery wheels, etc., on which there have been no changes in five or six years. The list on pipe fittings has not been changed in many years.

A Tennessee jobber says that he is in favor of list prices fixed high enough in order to afford room for fluctuations in net prices. He states that on wood screws there were no changes in list prices from 1903 to 1922. Recently, however, there have been a few changes in the list. This was done in order that the manufacturers could give uniform discounts. On machine bolts no change has been made since 1912. On pipe no change has been made since 1913.

A Wisconsin jobber says that he is in favor of adopting list prices that will stand. In the plumbing supplies line conditions are very much better and changes are few. He states that the list price and discount in the plumbing supplies line are much higher than in the electrical line.

A Rhode Island jobber states that the manufacturers of builders' hardware have made very few changes in list prices. He states that the list prices are changed practically only once a year and at that time new catalogs are published by the manufacturers showing the new lists.

An Ohio jobber says there are more changes in list prices in the electrical line than any other line which he handles, and his concern is in favor of doing away with lists and discounts and adopting only net prices.

Another Ohio jobber says that he has just finished a new catalog and the list price changes that have come along make him feel that his catalog is of little value. He states that in the hardware line most of the manufacturers change discounts rather than lists.

Another jobber writes:—"There is so much dissatisfaction among all the jobbers as to the price changes on wiring devices and the expensive way in which these changes are sent to the jobbers that something must be done. On a line of material like wiring devices it seems a crime to have fifteen or twenty different discounts on eight or ten different schedules and everything combined to make it so complicated that it costs the jobber too much to make a price change. Then he is hardly through with making one change when the manufacturer makes another one."

It would seem that a situation exists that should be studied carefully in the interests of the industry at large. The cost of distribution is everybody's trouble today. If we have here one avoidable element of cost — small though it may be in comparison with other factors—still it is worth consideration and reform.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

AFTER several very quiet weeks in which the electrical trade throughout the country has been in a condition of more or less suspended animation, with little buying pressure and the general flavor of declining prices, the forerunner of the fall market has made its appearance in the East. Both the Boston and New York markets report a decided improvement in demand, and if precedents are not to fail, this present quickening of trade along the Atlantic Coast is the beginning of the great buying period which will carry through the fall and winter and extend gradually across the United States. Such waves of seasonal fluctuation in the market usually have their inception in the Northeast and rapidly work westward to the Pacific.

Both manufacturers and jobbers have noted increased demand in the Eastern territory for practically the entire commodity list. The heaviest demand in the present market is for materials which enter into new building, and wiring devices and fixtures have shown the greatest activity in this improving market. Manufacturing circles report sufficient stocks of all wire, cable and wiring devices, but manufacturers of heavy machinery complain that their situation is being hampered considerably by lack of labor. Trade in used electrical machinery, however, is quiet.

During the week several large orders have come from Japan for copper and brass. It is yet too early, however, to estimate how much business America will receive for the restoration of power and light stations in the devastated section of that country.

Controller Business Exceptionally Large

RECENT increases in orders for motor-control equipment have begun to crowd existing manufacturing facilities so hard that there is little immediate prospect of improvement in delivery conditions in this branch of electrical apparatus production. Shipments are still being made on a reasonably satisfactory basis where special

designs are not involved. The importance of placing controller orders early for fall business is being emphasized in well-informed circles, and the purchaser's desire to keep inventories low is cited as an obstacle to the rendering of the best possible service on the part of the manufacturer. Time must be allotted for proper engineering analysis and for the design of equipment in applications of special character. To quite an extent, controller sales at the close of the summer have attained a momentum that bids fair to carry this class of business well into the winter without any marked diminution in volume. While it is true that midsummer sales were relatively quiet in some quarters, the "overhang" of last spring's very heavy demand is still being felt in manufacturing quarters.

Prices are firm and a great deal of interest is being shown in allied products like magnetic clutches and rheostats. An extremely active demand for radio rheostats has sprung up recently with every prospect of an intensely vigorous fall business, which some observers believe will tax manufacturing facilities to their utmost.

New England Collections Show Much Improvement

COLLECTIONS in New England show a distinct gain this month over August, and the outlook for the rest of the year is most encouraging. Some of the leading jobbers in this section still report very poor collection results for last month, and it is doubtful if the handling of accounts is as yet on a basis as satisfactory as that which prevailed during the spring. Public utilities, railroads and industrial concerns of all sorts are paying the jobber with reasonable promptness, and even the recent slump in textile production has not had much effect on credits. In that and other fields business is quickening all along the line. Steady improvement is expected from now on for several months. Dealer collections are the slowest, and new accounts are being closely scrutinized. Average settlements run from fifty-five to seventy days.

Outlook Improving for Electric Household Boilers

A DECIDEDLY encouraging outlook is indicated for electric household boilers in considering autumnal business prospects. This equipment has been passing through a period of development during the last year or two, and it has now apparently reached a degree of standardization that includes the usual 5, 10, 20 and 30-gal. tanks, with more recently added sizes up to 80 gal. Manufacturing facilities have been developed for the production of still larger units for special service when required. During this year the design has been improved by the use of heavy-gage copper for the inner tank in place of the former galvanized steel. This necessitated a price increase last spring, but since then prices have been steady and no immediate changes are in sight. Business this year has exceeded that of a year ago and negotiations are under way for the appointment of new agents in various quarters. Increased interest in the marketing of this product has lately been manifested in jobbing circles.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0337	$0.028
Cold finished shafting, per lb.	0.0433	0.0428	0.036
Brass rods, per lb.	0.1741	0.1825	0.1666
Solder (half and half), per lb.	0.276	0.276	0.228
Cotton waste, per lb.	0.1231	0.1231	0.1458
Washers, cast iron (⅛-in.), per 100 lb.	4.66	4.66	4.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	3.11
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	43⅓%
Machine bolts, up to 1-in. x 30-in., off list	44⅓%	44⅓%	53⅓%

Electrical Exports Show Increase of $1,700,000

EXPORTS of electrical materials from the United States during July of this year exceeded the shipments made in the same month of 1922 by almost $1,700,000, bringing the average for this year up to a point well in advance of the 1922 figures. A substantial increase was also shown over the June exports of electrical goods. Heavy power machinery, together with radio apparatus and bare copper wire, showed the largest gain during July. Unusually heavy shipments of large motors and electric meters were also made. Decreases as compared with the previous month were mainly in appliance lines and supplies. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR JULY, 1923, COMPARED WITH CORRESPONDING MONTH A YEAR AGO

	Value July 1922	Value July 1923
Turbines	$120,831	$6,000
Generators:		
Direct-current:		
Under 500 kw.	41,271	66,638
500 kw. and over	20,882	53,215
Alternating-current:		
Under 2,000 kva.	35,392	4,989
2,000 kva. and over	82,378	95,848
Accessories and parts for generators	251,709	59,757
Self-contained lighting outfits	52,571	56,723
Batteries:		
Primary	71,007	104,979
Storage	107,377	218,863
Transforming and converting apparatus:		
Power transformers	449,132	360,772
Other transformers	48,578	62,107
Rectifiers, condensers, double-current and motor-generators, dynamotors, synchronous and other converters	156,119	53,326
Transmission and distribution apparatus:		
Switchboard panels, except telephone	274,906	228,861
Switches and circuit breakers over 10 amp.	180,776	186,134
Fuses and fuse blocks	14,525	18,386
Meters and measuring instruments:		
Watt-hour and other measuring instruments	20,539	45,161
Volt, watt and ampere meters and other recording, indicating and testing apparatus	84,103	87,665
Lightning arresters, choke coils, reactors and other protective devices	23,988	92,961
Motors, starters and controllers:		
Motors under 1 hp.	70,944	117,295
Stationary motors, 1 to 200 hp.	172,002	189,334
Stationery motors over 200 hp.	155,061	100,789
Railway motors	46,746	196,416
Electric locomotives:		
Railway		273,246
Mining and industrial	8,809	5,852
Other motors	14,278	8,136
Rheostats, controllers and other starting and controlling equipment	39,346	142,030
Accessories and parts for motors	97,706	159,900
Electrical appliances:		
Electric fans	51,463	50,147
Electric lamps:		
Incandescent—		
Carbon-filament	5,629	4,168
Metal-filament	84,769	82,949
Other electric lamps	13,024	17,989
Flashlights	21,240	52,974
Searchlights and projectors	5,056	52,164
Motor-driven household devices	34,928	71,207
Domestic heating and cooking appliances	36,116	54,476
Industrial electric furnaces and ovens	12,618	27,177
Therapeutic apparatus and X-ray machines, galvanic and faradic batteries, etc.	42,307	78,106
Signal and communication devices:		
Radio and wireless apparatus	385,861	682,885
Telegraph apparatus	9,979	43,091
Telephone apparatus	240,310	
Magneto telephones		32,950
Other telephones		23,976
Magneto switchboards		475
Other telephone switchboards		12,033
Railway signals, switches and attachments	124,359	53,983
Bells, buzzers, annunciators and alarms	5,145	10,223
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos and other ignition apparatus	80,446	162,520
Insulating material	87,217	107,352
Metal conduit, outlet and switch boxes	27,202	47,700
Sockets, receptacles and lighting switches	34,070	83,490
Other wiring supplies and fixtures	89,738	146,602
Other electrical apparatus	444,901	742,258
Globes and shades for lighting fixtures	28,675	44,498
Electrical glassware, except for lighting	15,326	17,643
Electrical porcelain	86,570	143,820
Electrical carbons, carbon brushes and electrodes	99,286	215,289
Insulated wire and cable (iron and steel)	16,296	53,160
Other manufactures of aluminum	79,901	169,919
Copper:		
Bare wire	130,184	218,227
Insulated wire and cables	145,186	256,021
Total electrical machinery, apparatus and appurtenances	$5,078,777	$6,754,858

Demand Improves Sharply in the Eastern Market

A SHARP advance in the demand for electrical supplies featured the Eastern market Monday, current orders being well distributed as to localities and diversified as to material listed. Jobbers are looking for a very busy fall. Stocks are comfortably equal to immediate requirements and prices have become quieter. Considerable new life is appearing in the retail trade. The credit situation is improving to a marked degree over midsummer conditions. Central-station financing continues steadily to reflect the expanding demand for service, and plant developments are widespread. Wiring devices are active and the demand for insulated and bare wire is considerable being accompanied by spotty price conditions on large order quotations. A movement against appliance price cutting has begun in a quiet way.

General business is healthy; money is easy where collateral is of recognized quality, and labor conditions are giving little trouble. Building contracts ran ahead of last year for the latest reported week. Interest in radio apparatus has continued to grow during the past week although the market is heavily supplied with low-cost material.

San Francisco Business Helped Greatly by Effective Campaigns

RETAIL business is improving noticeably owing to the excellent constructive work of the several associations and societies. An intensive "better illumination" campaign is being planned for the fall by these bodies. Household device sales are improving, several well-established lines have been strengthened, and there are the usual rumors of invasion by new firms. In general the field is stronger than it was a year ago and is marked by the increasing importance of the neighborhood store as compared with indiscriminate door-to-door solicitation.

Copper wires have decreased somewhat, lamp cord is 10 per cent lower, bare and weatherproof bases are 50 cents lower, Rubber-covered shows weakening tendencies, but other lines are again in equilibrium, and some predict that the period of price recession is almost over.

No Important Changes in Chicago Territory

JOBBERS in the Chicago territory find business just about the same as during the last three weeks. There have been no important changes in prices and stocks remain about the same. Pole-line hardware demand was a little better this week than last because several jobbers bought considerable quantities of this material this week.

The conduit situation is just the same with regard to jobbers' stocks on hand. Prices are firm and there is no indication of an immediate advance in conduit prices. Building activities improved a little this week, and considerable interest has been aroused over the situation which has arisen between the Landis award committee and the contractors. It is at first reported that twelve contractors had refused to sign up with the Landis award committee, but this report was denied, it being asserted that several of the contractors named have been out of business for some time and that the others named in the report have renewed their pledges.

The Metal Market

DOMESTIC demand for copper shows no improvement and the price remains the same as two weeks ago. Japanese demand for copper has spurted, and a leading interest which always handles business from that country has received numerous inquiries. None of these is for a large amount but individually they run from 100 tons to 300 tons, and the aggregate of all the inquiries that have been received is substantial.

NEW YORK METAL MARKET PRICES

	Sept. 5, 1923 Cents per Pound	Sept. 12, 1923 Cents per Pound
Copper, electrolytic	13.7	13.75
Lead, Am.S.& R.price	6.75	6.80
Antimony	7.605	7.50
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.55	6.50
Tin, Straits	43.00	41.75
Aluminum, 98 to 99 per cent	25.00	25.00 to 26.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Allis-Chalmers Unfilled Orders Are at $13,000,000

"Unfilled orders as of Sept. 1 totaled about $13,000,000," said Otto H. Falk, president of the Allis-Chalmers Manufacturing Company. "Bookings and billings are about equal at present. While there has been a slight falling off in business, we look for an early increase in volume. Production is somewhat hampered by shortage of labor. With more men, especially skilled labor, operations could be increased."

Larger Plant for Walker Vehicle

Completion in the latter part of September of an addition to the new factory of the Walker Vehicle Company, Chicago, manufacturer of the Walker "balance drive" electric trucks, is anticipated. The present factory, at State and Eighty-seventh Streets, was erected two years ago. The addition now under construction is a strictly modern and fireproof building, 360 ft. x 100 ft., of steel, concrete and brick. The new building is to house four new electric heat-treating furnaces and the frame assembly department.

The press of orders which has kept the present Walker factory busy day and night is responsible for the addition. It is estimated that this addition plus the new manufacturing facilities of Walker Vehicles, Limited, of England, will more than double the total Walker production this year.

Standard Turbine Appointments

The Standard Turbine Corporation, Wellsville, N. Y., announces the appointment of H. R. Geiger as its New York manager. Mr. Geiger is well known as an engineer and sales representative in metropolitan engineering and trade circles. His office is at 350 Madison Avenue, New York City.

Standard Turbine also announces the appointment of the Percy E. Wright Engineering Company as its Seattle agent with office at 2012 L. C. Smith Building, Seattle.

Hawthorne Works of Western Electric Now Employs 33,700

More than 33,700 men and women now are employed in the shops and offices of the Hawthorne works of the Western Electric Company. This is approximately 5 per cent of the total working force of Chicago industries. The Hawthorne works have now reached a point where they are almost twice as big as any other manufacturing organization in Illinois.

During the last five years the number of workers has more than doubled. On Sept. 10, 1918, there were 16,000; on Aug. 12 of last year there were 25,900, and on Jan. 1 of this year 28,400. During the past two weeks it is estimated that 700 additional employees have been brought into the organization. The continued expansion of the Bell Telephone System and the steady demand for Western Electric communication equipment are chiefly responsible for this rapid growth.

Edison Appliance Honor Tablet Awarded to New York District

The Hotpoint "tablet of honor," which is awarded from time to time to the sales districts of the Edison Appliance Company, Inc., Chicago, for unusual performance in upbuilding the business of that company, has just been given to the New York district salesmen in charge of W. B. Pierce. More than 20,000 "Headlite" heaters were sold in a campaign running in June and July in New York, Pennsylvania, Connecticut, Maryland, Virginia, West Virginia, Delaware and the District of Columbia,

which are included in the New York district.

The campaign just ended is the second to be recorded on the tablet. The first, the "expansion campaign," was won by the Pacific Coast district, P. H. Booth in charge, for sales in April and May. The company recently started its third contest, to run through September, to promote sales of holiday goods.

Uehling Instrument Appoints Southern Representatives

The Uehling Instrument Company, Paterson, N. J., combustion engineers and manufacturers of steam-power-plant economy apparatus, including CO_2 records, has appointed three new Southern representatives, namely, the Connor-Hudson Company, Southwestern Life Building, Dallas, Tex.; Gibbens & Gordon, Inc., 532 Canal Street, New Orleans, and the Cornell Mathews Company, 10 Oak Street, Orlando, Fla. These new representatives are fully equipped to give the personal service demanded by the growing business in the Gulf States.

Westinghouse Brooklyn Edison and Pennsylvania Railroad Orders

The Westinghouse Electric & Manufacturing Company is now executing orders for the Brooklyn Edison Company to the amount of approximately $2,225,000. These orders are for electrical machinery and include the largest transformers ever built. Special freight cars had to be constructed to transport the apparatus. One unit was so large it had to be shipped in sections. This is part of central-station expansion caused by increased industrial development and the continued selling activity in Brooklyn. The development project of the Brooklyn company will aggregate about $26,000,000.

The Pennsylvania Railroad Company has placed an order amounting to approximately $300,000 with Westinghouse for railway motors and control apparatus to equip three new-type electric locomotives. Four of the big motors, the largest single-phase commutator-type traction motors ever built, will be installed on each locomotive. The motors have a continuous rating of 768 hp. The mechanical parts of the locomotives are now being built at its Altoona shops by the Pennsylvania Railroad Company.

Magee Furnace Plant Enlarged and Representation Increased

R. P. Burton, vice-president Magee Furnace Company, Boston, in speaking to a representative of the ELECTRICAL WORLD last week, declared that electric range sales are running ahead of last year's by at least 25 per cent and that the outlook for fall business is decidedly good. At the Taunton (Mass.) factory of this company an addition, 25 ft. x 140 ft., has just been completed to furnish much-needed additional foundry facilities. Mr. Burton said that deliveries are in excellent shape and that while the demand is active for "straight" electric ranges, much interest is also being shown by the public in combination coal and electric ranges. Combination gas and electric ranges are selling too, but in relatively smaller numbers on account of the double expense of wiring and gas-piping connections involved. Tabler & Lyons, Inc., 315 Baronne Street, New Orleans, manufacturers' agents, have been appointed representatives of the Magee company for Alabama, Arkansas, Florida, Louisiana and Mississippi.

The Union Carbide & Carbon Corporation, 30 East Forty-second Street, New York City, has arranged an appropriation of more than $5,000,000 for extensions in its plants in different parts of the country. The Linde Company division is commencing the erection of a plant at Tulsa, Okla., of which the first unit will cost about $250,000, with equipment.

The Illinois Wire & Cable Company, Sycamore, Ill., has secured additional manufacturing space, in which drawing and stranding equipment for the manufacture of the finer sizes of bare copper wire and cable is being installed.

The General Electric Company has at present unfilled orders on the books at the rate of an annual volume of $300,000,000. Inquiries are said to be very encouraging. At the close of the year orders aggregating $242,739,000 stood on the books. Business has fallen off slightly—perhaps 10 per cent—from the peak of the year, but the volume coming in is entirely satisfactory and the future looks encouraging. Foreign orders stand about on a par with those of last year, and this part of the business shows a prospect about as good as the domestic business.

The Triumph Electric Company has opened a district office at No. 500 South Brevard Street, Charlotte, N. C., with J. McL. Jones as district manager. Mr. Jones has been intimately connected with the electrical industry in North and South Carolina for the past twelve or fifteen years, with the Southern Utility & Power Company, under James B. Duke.

The Mianus Diesel Engine Company, Stamford, Conn., recently formed with a capital of $1,500,000, will succeed to the business of the Mianus Motor Works, Inc., continuing in the manufacture of internal-combustion engines, with particular activity in the line of Diesel units. The new company is headed by M. E. O'Connell and Charles F. Bailey, 2226 Loring Place, New York.

The Line Material Company, Milwaukee, announces the establishment of offices and warehouses in two Eastern cities—one at 524 East 134th Street, New York City, and the other, a New England office and warehouse, at 120 Sidney Street, Cambridge, Mass. At the same time the former Eastern office at Albany, N. Y., will be discontinued. The New York office and warehouse will be under the direction of the company's Eastern manager, J. M. Kline. The New England office and warehouse will be in charge of H. J. Eslow. This company maintains a Cleveland warehouse, which has been considerably increased in size, at No. 8009 Wade Park Avenue. It is in charge of K. F. Ruthenberg.

The Irvington Varnish & Insulator Company, San Francisco, has taken over the selling agency of the output of the Harvey Wire Company, Newark, N. J., manufacturer of enameled wire, silk and cotton-covered wire, etc.

The Western Transformer Company has moved to new and larger quarters at 618 East Eleventh Street, Oakland, Cal.

Bernard Minn has been elected president of the Safety Highway Engineering Company, Milwaukee, at 1409 Fifteenth Street. This company has been capitalized at $1,000,000 and will manufacture an electric highway traffic signal, holding patent rights in the United States and Canada for the device. Other officers elected are: H. C. Hoppman, vice-president; W. A. Richter, secretary-treasurer; P. W. Kramer and Hal Cunningham, directors.

The Page & Hill Company of Minneapolis has appointed Lawrence E. Morier Eastern sales manager, with headquarters at Dayton. Mr. Morier has long been connected with the pole industry, having served for seventeen years in this field. Early in 1922 he left this industry to act as treasurer of the V. & O. Press Company of Brooklyn, N. Y., but now returns to his original line.

The Pelton Water Wheel Company, San Francisco, has completed plans and will soon take bids for the erection of a new addition to its plant to provide for considerable increase in production. It will cost approximately $100,000, with equipment. W. W. Hanscom, 848 Clayton Street, is engineer.

The Packard Electric Company, Warren, Ohio, is completing revised plans for the erection of its proposed new plant addition and expects to take bids on a general contract at an early date. The factory will be three-story and basement, brick, 85 ft. x 200 ft., on Dana Avenue. Keich, O'Brien & Hasken, Western Reserve Bank Building, are structural engineers, in charge.

The Steel City Electric Company, Pittsburgh, announces that it has added the State of Connecticut to the territory served by Kearton & Nagle, 71 West Twenty-third Street, New York City.

The Acme Electrical Manufacturing Company, formerly of Milwaukee, has removed its factory and offices to Madison, Wis, This company announces that it has increased its capitalization and is now developing a line of electrical devices including household utensils, soldering irons, cigar lighters, a general line of heating devices and electric controllers and starters.

Foreign Trade Opportunities

INQUIRIES FOR ELECTRIC BREAD-BAKING OVENS IN JAPAN.—Inquiries for commercial electric bread-baking ovens have been received by H. F. Hawley, United States Consul, Nagoya, Japan. The Consul asks American manufacturers interested in the Japanese market for this line to send descriptive literature, etc., to his office at Nagoya, in order that it may be available to persons interested.

EXTENSIONS PROPOSED TO ELECTRIC PLANT IN GUATEMALA CITY, GUATEMALA. — An expansion program, which includes the reconstruction of the present transmission line, the erection of a new 60,000-volt transmission line from Guatemala City to Galin, installation of a new 600-hp. water turbine at the Zapote plant and the purchase of two high-voltage transformers for the Guatemala City substation, has been announced by American Foreign Power & Light Company, Guatemala City. The cost is estimated at $261,250.

INCREASING DEMAND FOR X-RAY APPARATUS IN HONGKONG DISTRICT, CHINA.—An increasing demand for X-ray apparatus in Hongkong, *Commerce Reports* states, is evidenced by the fact that leading importing houses are making arrangements to handle such goods. The Hongkong district, which comprises the nearby provinces of China, contains over fifty military and civil hospitals and a large number of foreign missions equipped with modern hospital apparatus. The yearly imports of X-ray apparatus and auxiliary parts are estimated at $50,000. Only the best grade of portable equipment is used. The current supply is 110 volts and 220 volts, alternating current or direct current, varying in different cities in South China. A list of importers and dealers in X-ray equipment may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, at Washington, D. C., or any of the bureau districts by referring to file No. 99,837.

PROPOSED EXTENSION OF ELECTRIC SERVICE TO RURAL COMMUNITIES IN FRANCE.—In the closing days of the session of 1923 the French Parliament, according to *Commerce Reports*, passed a long-advocated measure for the extension of electrical service to rural communities. More general use of electricity on the farms, it is believed, will partly offset shortage of farm labor caused by the depletion of man power during the war. Besides, household industries, now hard pressed by manufacturers in the great industrial centers, will be strengthed, thus assuring the continuance of one of the supplemental sources of income which is important in many of the departments of France. The general purpose of the new law is to place at the disposition of the National Office of Agricultural Credit a maximum sum of 600 000,000 francs to be employed in rural electrical development through advances of cash to be made to the smaller political units or associations of individuals. The detail of administration is to be provided by regulations issued by the government to supplement the terms of the law.

New Apparatus and Publications

CONTROL PANEL. — The Automatic Electric Heater Company, Warren, Pa., has brought out a new "Speco" flush-type timeter control panel for use with its electric water heaters.

MAGNETIC SEPARATOR.—Bulletin No. 66 issued by the Magnetic Manufacturing Company, Milwaukee, describes and illustrates its new type "H" magnetic separator.

SERVICE SWITCH. — The Johns-Pratt Company, Hartford, Conn., has published a new catalog covering its new "Noark" universal service switch.

DESK SET AND ELECTRIC LAMP.—The Weidlich Brothers Manufacturing Company, Bridgeport, Conn., is manufacturing a combination desk set and electric lamp.

FLASHLIGHT.—The Yale Electric Corporation, Brooklyn, N. Y., has developed the new Yale "3-in-1" flashlight, which may be equipped with either one red, one green and one white bulb or with three clear "Mazda" bulbs.

ELECTRIC IRONING MACHINE.—The Manco Manufacturing Company, Bradley, Ill., has brought out a new "Keystone" electric ironer.

SOLDERING IRON.—The Rohne Electric Company, Minneapolis, has developed a soldering iron, "Sta-Warm." This device is made ready for use by simply screwing it into a lamp socket.

ELECTRIC RANGE. — The Walker & Pratt Manufacturing Company, 31 Union Street, Boston, has announced through its distributor, the Western Electric Company, 195 Broadway, New York City, its new "16-80" Crawford cabinet electric range.

ELECTRIC RESTAURANT.—The DuCharme Electrical Manufacturing Company, 2618 Detroit Avenue, Cleveland, has brought out the "DuCharme" electric restaurant type "60," equipped with three combination units and a hot plate. The company also makes a model A-5 for use in the home.

ELECTRIC STOVES. — The Stoughton (Wis.) Manufacturing Corporation has placed on the market its "Clark" line of electric stoves. These stoves may be obtained in two, three and four-burner models and without the oven.

VIOLET-RAY OUTFIT. — A new two-piece violet ray, known as No. 199, has been brought out by the Shelton Electric Company, 16 East Forty-second Street, New York City.

ELECTRIC COOKER. — The Martin Products Company, 625 Market Street, San Francisco, has placed on the market an electric portable cooker, "Kercher," which can be attached to any lamp socket.

SMALL ELECTRIC RADIATOR.—The Simplex Electric Heating Company, 35 Sidney Street, Cambridge, 39, Mass,, has placed on the market its "Sunbowl Junior" radiant heater.

POPCORN POPPER AND PEANUT WARMER.—A new electric popcorn popper and peanut warmer, No. 993, has been placed on the market by the Kingery Manufacturing Company, Cincinnati.

WINDSHIELD SPOTLIGHT.—The Clymer Manufacturing Company, Denver, has developed a new windshield spotlight which can be turned instantly in any direction desired.

COMBINATION BENCH MACHINE.—The "Pony" bench machine manufactured by William B. and John E. Boice, 114 Twenty-third Street, Toledo, Ohio, includes a bench saw, drill, sander, grinder, polisher and buffer for working in wood and soft metals.

IRONING MACHINE. — The Holland Maid Company, Holland, Mich., has brought out an electric ironing machine with several new features.

WASHING MACHINE. — The Victor Manufacturing Company, Leavenworth, Kan., has developed a new electric washing machine, "Wonder," of the vacuum type.

SMALL ELECTRIC WASHER. — The Geyser Electric Company, 5508 Bloomingdale Avenue, Chicago, has brought out a small-sized electric washer for use in apartment houses.

ELECTROTHERAPEUTIC HIGH-FREQUENCY APPARATUS. — The William Meyer Company, 1644 North Girard Street, Chicago, has placed on the market an electrotherapeutic high-frequency apparatus, known as G405, which is smaller than the usual portable type.

PORTABLE HEATERS.— The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, has added four new models to its "Hedlite" line of heaters. Model A-29 furnishes three de luxe types of these heaters, which are finished in antique bronze, florentine relief and old ivory. Model A-30 is finished in mahogany and has a 12-in. reflector.

ELECTRIC RANGE. — The Rathbone-Sard Electric Company, Aurora, Ill., has brought out a new electric "Acorn" range, provided with baking oven and broiling oven.

New Incorporations

THE OHIO FARMERS ELECTRIC COMPANY, Mansfield, Ohio, has been incorporated by D. R. Whitlock, E. H. Barrett, C. W. Wolf, J. M. Hepp and H. O. Wolf. The company is capitalized at $15,000.

THE SNO-MON ELECTRIC COMPANY, Snohomish, Wash., has been incorporated with a capital stock of $100,000 by T. N. Bennett and others.

THE ST. CHARLES (KY.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $2,000 by W. L. Morse, H. E. Kinnett and M. T. Cranor, all of St. Charles.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

EVERETT, MASS. — The Boston Elevated Railway Company, 108 Massachusetts Avenue, Boston, is completing plans for the erection of the superstructure for its proposed local power plant. Jackson & Moreland, 387 Washington Street, Boston, are architects.

SALEM, MASS.—The Salem Terminal Company, operated by Charles H. Tenney & Company, 201 Devonshire Street, Boston, engineers, has purchased a site on Derby Street for the erection of a steam-operated electric generating plant to cost close to $500,000, to be of superpower type, for local commercial service.

PROVIDENCE, R. I.—Electric power equipment will be installed in the three-story addition to be erected by the Davol Rubber Company, Point and Eddy Streets, to cost about $75,000.

MILFORD, CONN. — The Connecticut Light & Power Company will soon commence the construction of a new power plant on the Housatonic River, to cost about $675,000, with machinery.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 18, for one motor-generator set, 500 kw. capacity, complete with three-panel switchboard. (Schedule 1281.)

HORNELL, N. Y.—The Holland Lumber Company is reported to be considering the construction of a power house at its proposed new mill.

NORTH TONAWANDA, N. Y., The Ontario Paper Company, Thorold, Ont., plans for the construction of a power plant at its proposed local paper mill on Little Island, estimated to cost $3,000,000. Warren Curtis is general manager.

NORWOOD, N. Y. — Electric power equipment will be installed in the new local plant to be erected by the Martin Pulp & Paper Company, estimated to cost $150,000.

TOTTENVILLE, N. Y.—The Staten Island Edison Company will make extensions and improvements in the street-lighting system in different parts of Richmond Borough, including the installation of new lamps.

KEARNY, N. J.—Plans are being perfected for extensions and improvements in the street-lighting system on main streets, including the use of 1,200-cp. and 600-cp. units instead of present arc lamps.

WALLINGTON, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, 24 Branford Place, Newark, until Oct. 2, for two 10-kw. generators and other electrical equipment for installation at the local pumping station. Joseph H. Quigg is clerk.

WESTMONT, N. J.—Plans are being perfected for the installation of electrically operated pumping machinery at the municipal waterworks at Crystal Lake.

BALLY, PA.—Gebman Knitting Company will build a one-story power house at its mill.

HANOVER, PA.—The Hanover Power Company plans for extensions in its transmission lines in Hanover Borough and Penn Township.

NAZARETH, PA. — The Confederated Home Abattoir Company, 314 American Casualty Building, Reading, Pa., plans for the construction of a power house at its proposed plant on the Mauch Chunk Road, to cost about $65,000. The Gorman-Brown Engineering Company, 40 Rector Street, New York, is engineer.

NEW CUMBERLAND, PA.—Plans are being considered for the installation of an electric fire-alarm system.

PHILADELPHIA, PA. — Arrangements are being perfected for the installation of an improved street-lighting system on Broad Street, using 1,000 cp. units to replace present arc lights. The city Electrical Bureau is in charge.

PHILADELPHIA, PA. — The Sandy Creek Township Power Company, French Creek Township Power Company and Greenfield Township Power Company, now being organized by C. A. McClure and associates, plan for the installation of transmission lines and substations in the respective territories. James C. Jones, Bullitt Building, is representative.

PHILADELPHIA, PA.—Electric power equipment will be installed in the six-story plant addition to be erected by the Edward G. Budd Manufacturing Company, Hunting Park Avenue, manufacturer of automobile bodies, estimated to cost $800,000.

PHILADELPHIA, PA.—Plans are being arranged by the Department of Public Works for the installation of electrically operated pumping equipment at the municipal waterworks. Germantown and Southampton Avenues.

ANNAPOLIS, MD.—The Annapolis & Chesapeake Bay Power Company is arranging for a bond issue of $800,000, of which about $200,000 will be used for extensions and improvements.

BALTIMORE, MD.—An electric-steam power house will be erected at the new plant for Archer's Laundry, Mulberry and Howard Streets, estimated to cost $500,000, of which about $200,000 will be expended for machinery.

CECILTON, MD.—Plans are under consideration for the installation of a municipal electric lighting system. An appropriation is being arranged.

JENNINGS, MD.—The Morgart Coal Mining Corporation will install electric power and mechanical equipment at its mines in the northern section of Garrett County. The entire property will be electrified. William A. Morgart is president.

WESTPORT, MD. — The Consolidated Gas, Electric Light & Power Company has arranged an appropriation of about $1,000,000 for additions in its local generating plant, to increase the capacity to 53,000 hp. Extensions will also be made to the Penn Street power plant, Baltimore, to cost approximately $100,000.

BRADY, VA.—The Brady Mining Company, McLean, Va., plans for the construction of a power house at its local copper properties. F. N. Hagman, Vienna, Va., heads the company.

DAMASCUS, VA.—The capital stock of the Damascus Light & Power Company has been increased from $10,000 to $50,000.

MONETA, VA.—The Moneta Mineral & Mining Company plans to build a power plant at its local feldspar properties.

SALEM, VA.—The Crown Coal Company, recently formed with a capital of $250 000, contemplates the installation of electric power and mechanical equipment at its properties. M. J. Anderson is president.

CHARLESTON, W. VA.—The Virginian Power Company has purchased property in the vicinity of its electric generating plant at Cabin Creek Junction and contemplates the construction of an addition.

LOGAN, W. VA.—The Guyan Machine Shops have inquiries out for several transformers, 10, 15 and 20 kva. capacity, with fuses, hangers, lightning arresters, etc.

WESTON, W. VA.—The Monongahela-West Penn Power Public Service Company, Fairmont, it is stated, contemplates erecting a high-tension transmission line from Weston to Buckhannon, a distance of 15 miles.

North Central States

DETROIT, MICH.—Construction of an addition to the municipal power plant will be commenced, with equipment installation to increase the capacity from 10,000 kw. to 25,000 kw., for which bonds for $1,000,000 recently were voted.

GRAND RAPIDS, MICH.—A permit has been granted to the Kliss Manufacturing Company for the erection of a power plant at 50 Cottage Grove Street, S.W., to cost $10,000. Contract has been awarded for the building.

IRON MOUNTAIN, MICH.—Plans have been prepared by A. Kahn, Marquette Building, Detroit, for a power house for the Ford Motor Company, Highland Park.

RAMSAY, MICH.—The Castile Mining Company plans for the construction of a power house at its new shaft, including machine shop and other structures, estimated to cost $350,000.

ST. JOSEPH, MICH.—The Auto Specialties Company contemplates the construction of a new power house in connection with general plant expansion, estimated to cost $200,000.

WINONA, MICH.—Plans are being considered for the installation of electrically operated pumping machinery in connection with extensions and improvements in the municipal water plant. Alvord, Burdck & Howson, 8 South Dearborn Street, Chcago, Ill., are engneers.

ZILWAUKEE, MICH. — Superstructure work will soon be commenced on the proposed local electric generating plant of the Consumers' Power Company, estimated to cost $1,250,000.

HAMILTON, OHIO.—The City Council, it is understood, has engaged the Froelich & Emory Company, Toledo, to prepare plans for the proposed new municipal electric plant, for which $650,000 in bonds has been voted.

TORONTO, OHIO.—The Ohio River Edison Company has applied to the federal engineers at Pittsburgh, Pa., for permission to construct and operate an electric generating plant on the Ohio River, near Toronto, to cost about $1,000,000, to include coal-handling plant, ice breakers, harbor terminal and other subsidiary works.

DAWSON SPRINGS, KY.—Bids will be received at the United States Veterans' Bureau, Room 790, Arlington Building, Washington, D. C., until Sept. 29 for construction complete of outside service lines for heating, drainage, hot and cold water supplies and electric current for recreation building and four duplex officers' quarters under construction at the United States Veterans' Hospital No. 79, at Dawson Springs.

HOPKINSVILLE, KY.—The Kentucky-Tennessee Light & Power Company will commence the construction of its proposed steam-operated electric power plant, estimated to cost $300,000. It will be designed for an ultimate output of 9,000 kw., with initial installation approximating 3,000 kw.

MADISONVILLE, KY.—The North Star Coal Company plans to install electric power and mechanical equipment at its local properties.

PARIS, KY.—The Paris Gas & Electric Company is planning for the rebuilding of the portion of its power plant, recently destroyed by fire.

SOMERSET, KY.—The Kentucky Utilities Company, it is stated, has appropriated $200,000 for the erection of a 33,000-volt transmission line from Somerset to the Dix River and a substation in Somerset.

INDIANAPOLIS, IND.—The Excelsior Laundry Company, 222 North Alabama Street, has plans for the construction of a two-story electric-steam power house at its new plant on North New Jersey Street, estimated to cost $300,000. Blaine H. Miller is president.

MACOMB, ILL.—The Department of Public Works and Buildings, Springfield, Ill., has plans in preparation for the construction of a power house at the local State Teachers' College, estimated to cost $125,000. E. A. Martin, 304 South Wabash Avenue, Chicago, Ill., is architect.

SHAWANO, WIS.—The installation of an ornamental lighting system on Main Street is under consideration, the cost to be paid by property owners.

EAU CLAIRE, WIS.—A movement has been started to extend the ornamental lighting system from the downtown section to the Omaha railroad station.

TWO RIVERS, WIS. — The municipal street program for 1924, to cost $97,000, includes a provision for an extension to the ornamental lighting system.

MANITOWOC, WIS. — The Municipal Public Utilities Commission contemplates extending the electric light and power lines along the Plank Road and also to the Menchal subdivision of the city.

ST. JOSEPH, MO.—The St. Joseph Railway, Light & Power Company, it is reported, is planning to build a new electric plant, to cost about $1,000,000.

KANSAS CITY, MO.—The Kansas City Power & Light Company has plans in preparation for the construction of a one-story power plant, 80 ft. x 140 ft., at Sixth and Penn Streets, to cost about $60,000.

ST. CLOUD, MINN. — Permission has been granted to the Pike Rapids Power Company, St. Cloud, to build a hydro-electric plant.

WATERLOO, IOWA.—Work will soon ocmmence on the installation of a street-lighting system on West Fifth Street, Jefferson to Washington Street, and on East Fourth Street, Mulberry to Walnut Street.

COLUMBUS, NEB.—An election will be held in October to vote on the proposal to issue $15,000 in bonds for the installation of an electric plant by a proposed corporation of a rural electric light district. The company plans to erect a transmission line to supply electricity to all farms in the lighting district. Energy will be secured from the Columbus Light, Heat & Power Company.

STANTON, NEB.—The Council is considering the erection of an electric transmission line to connect with the transmission system of the Continental Gas & Electric Corporation, Omaha, to secure electricity, instead of generating it at the municipal plant.

TOPEKA, KAN.—Surveys are being made for a double-circuit, steel-tower transmission line from the new power plant at Tecumseh to Atchison, following the right-of-way of the Santa Fé railroad between Meriden and Atchison, to be erected by the Topeka Edison Company and the Atchison Railway, Light & Power Company.

WICHITA, KAN. — The Crystal Ice & Fuel Company plans to build an addition to its power house on North Osage Street.

Southern States

ASHEVILLE, N. C.—The Asheville Light & Power Company has purchased the plants and system of the North Carolina Electrical Power Company on the Ivy and French Broad Rivers for a consideration of $500,000 and will consolidate the property. Extensions are planned in transmission systems for interchange of service.

SYLVIA, N. C.—The Carolina Pole Company contemplates the construction of a power house at its new pole-treating plant on the Cullowhee Road, to cost approximately $75,000. J. L. Dilliard is secretary.

MACON, GA.—Plans are under consideration for the installation of electrically operated pumping machinery, in connection with waterworks expansion, to cost about $100,000.

SYLVESTER, GA.—Plans are being considered for the installation of electrically operated pumping machinery at the municipal waterworks to replace present steam equipment.

TALLAPOOSA, GA.—The Tallapoosa River Power & Textile Corporation, recently formed with a capital of $500,000, contemplates the construction of a hydro-electric power plant on the Tallapoosa River to cost close to $175,000. W. W. Summerlin, Camp, Ala., heads the company.

CORDELE, GA. — The Crisp County Lumber Company plans for the rebuilding of its power house and mill, recently destroyed by fire with loss estimated at $100,000, including equipment.

RUSSELLVILLE, ALA. — The Alabama Power Company, it is reported, contemplates the erection of a transmission line from Montgomery to Russellville.

TALLADEGA, ALA.—The City Council is planning to install electrically operated centrifugal pumps of 1,750 gal. per minute capacity at the dam to be built at Taylor's Mill.

ORLANDO, FLA.—The proposal to issue $525,000 in bonds for extensions to electric light and waterworks systems is under consideration.

TAMPA, FLA.—The Whiting Railway Motor Car Company contemplates the installation of a power house at its proposed local plant for the manufacture of gasoline-operated railway cars. J. A. Whiting is vice-president.

LAKEWORTH, FLA.—The Council is considering an issue of $60,000 in bonds for extensions to the municipal electric light plant and waterworks.

JOHNSON CITY, TENN.—The Council contemplates calling an election to vote on the proposal to issue $40,000 in bonds for the construction of an incinerator plant, electric fire-alarm system and ornamental lighting system.

MEMPHIS, TENN—The Jones & Laughlin Steel Corporation, Pittsburgh, Pa., contemplates the construction of a power house at its proposed local steel works on waterfront site, recently acquired.

BATON ROUGE, LA.—At an election to be held in September the proposal to grant a franchise to the Baton Rouge Electric Company will be submitted to the voters. Extensions and improvements, involving an expenditure of about $500,000, are under consideration by the company.

PADEN, OKLA.—Bonds to the amount of $25,000 have been voted for the erection of a transmission line, distribution system and for pumping equipment. Gantt & Baker, First National Bank Building, Oklahoma City, are engineers.

CHICKASHA, OKLA. — The Chickasha Gas & Electric Company is planning to erect a transmission line between Minco and Pocassett.

PICHER, OKLA.—The Keltner Mining Company contemplates rebuilding its plant and power house, recently damaged by fire. The loss is estimated at $100,000.

ORANGE, TEX.—The Orange Ice, Light & Water Company contemplates extensions to its transmission lines, to cost about $50,000.

FORT WORTH, TEX.—The Fort Worth Power & Light Company contemplates erecting a transmission line from Twenty-fifth and North Main Streets to Lake Worth, a distance of 6 miles, to cost from $25,000 to $30,000.

DALLAS, OAK CLIFF STATION, TEX.—The installation of an ornamental lighting system on Tyler Street is under consideration. O. T. Cox is chairman of committee.

COLEMAN, TEX.—The West Texas Utilities Company is negotiating for the purchase of the municipal electric plant. The transmission system will be extended and substation equipment installed.

Pacific and Mountain States

SEATTLE, WASH.—The Puget Sound Light & Power Company has plans for the erection of a substation at Western and Union Avenues, estimated to cost $50,000.

TACOMA, WASH.—Plans have been authorized for extensions and improvements in the municipal power house to cost about $58,000.

BEND, ORE.—The Cove Power Company will build an addition to its power plant, with additional outdoor-type substation and line extensions, estimated to cost $100,000.

PRINEVILLE, ORE.—Extensions are contemplated by the Deschutes Power Company, including the installation of an additional generating unit in the Cove power plant, the construction of a new concrete building to house the new and present units, a concrete spillway, a new outdoor substation at the lower tower, etc., to cost between $80,000 and $100,000.

BAKERSFIELD, CAL.—Plans are under consideration for the installation of a street-lighting system in the East Bakersfield district.

BRAWLEY, CAL.—The Holton Power Company, Riverside, is planning to install an ornamental lighting system to be maintained by underground wires.

CARMICHAEL, CAL.—Petitions have been circulated calling for an election to vote on the proposal to establish a public utility district for the distribution of electricity to each tract in the district.

GLENDALE, CAL.—Plans have been ordered prepared for the installation of an ornamental lighting system on Central Avenue, between Wilson and Arden Avenues, using single-light standards, and on the same street, between Wilson and San Fernando Avenues, two-light standards.

LAKE ARROWHEAD, CAL.—The Southern California Edison Company is planning to erect a new steel-tower transmission line from City Creek Canyon to Lake Arrowhead.

LOS ANGELES, CAL.—The City Council has adopted an ordinance calling for the installation of ornamental lamps on West Washington Street from Main to Vermont Street and from Hobert to Eighth Avenue. The installation of ornamental lamps on Vermont Avenue between Third and Middlebury Streets has been recommended by the Council.

QUINCY, CAL.—A. J. Watson and associates plan the construction of a hydro-electric power plant and have made application to the State Water Department for permission to use waters from the Red Clover and Last Chance Creeks. The proposed plant is estimated to cost $675,000.

SAN LEANDRO, CAL.—Plans are under way for extensions in the ornamental lighting system on Davis Street. Robert Goodwin is city engineer.

SAN LUIS OBISPO, CAL.—The Southern Pacific Railroad Company will build a new power house at its local shops, estimated to cost $55,000.

SANTA BARBARA, CAL.—Steps are being taken for the installation of an ornamental lighting system on State Street through the business district. The local Commercial Club is interested.

SEAL BEACH, CAL.—The Associated Oil Company, Los Angeles, is planning for the construction of an overhead transmission line across the entrance to Anaheim Bay.

LOGAN, UTAH.—Contracts have been awarded by the City Council for the construction of a new municipal hydro-electric plant in the Logan Canyon to cost about $200,000.

NOGALES, ARIZ.—The Southern Arizona Power Company has issued bonds for $675,000, a portion of the proceeds to be used for extensions.

Electrical Patents

Announced by U. S. Patent Office

(Issued Aug. 21, 1923)

1,465,688. INCASED CIRCUIT CONNECTING AND CONTROLLING DEVICE; Joseph Sachs, Hartford, Conn. App. filed Jan. 12, 1918. Fuses may be inserted or removed from exterior without unsealing or opening cabinet.

1,465,709. BRUSH-HOLDING MEANS FOR ELECTRIC MOTORS; P. I. Chandeysson, St. Louis, Mo. App. filed March 24, 1922. Spring arrangement adapted to large range of adjustment.

1,465,732. SYSTEM OF COMMUNICATION; R. A. Heising, East Orange, N. J. App. filed Sept. 23, 1919. Signaling capacity equivalent to that of a plurality of land lines.

1,465,735. PULL-SOCKET CURRENT TAP; J. W. Lavine, Bridgeport, Conn. App. filed Aug. 1, 1921. Provided with constantly "live" supplemental terminals.

1,465,753. ADVERTISING APPARATUS; Albert Angel, Cleveland, Ohio. App. filed Dec. 9, 1920. Attention called to apparatus by light or sound.

1,465,757. ELECTRICAL WAVE FILTER; A. M. Curtis, East Orange, N. J. App. filed Oct. 8, 1917. Composed only of resistance and one form of reactance.

1,465,758. ELECTRICAL WAVE FILTER; A. M. Curtis, East Orange, N. J. App. filed Oct. 8, 1917. Unidirectional element between adjacent filter sections.

1,465,809. ELECTRIC HEATING APPARATUS; G. R. Conklin, Norman, Okla. App. filed Nov. 14, 1921. Separate heating units may be connected to both sides of three-wire distributing system.

1,465,816. ADAPTER; G. W. Goodridge, Bridgeport, Conn. App. filed May 27, 1918. Edison receptacle may be converted into an Ediswan receptacle.

1,465,820. POWER-OPERATED CHUCK; H. M. Hay, Wenonah, N. J. App. filed Feb. 8, 1921. Motor field and armature members of annular form, one being fixed to chuck body and other rotatable about hub.

1,465,838. HAIR IRON; J. P. Caneavri, Port Arthur, Tex. App. filed Aug. 1, 1921. For crimping or straightening the hair.

1,465,872. HEADLIGHT-DIMMING DEVICE; A. N. Schoenung, Chilton, Wis. App. filed July 11, 1922. For controlling the brilliancy of illumination.

1,465,873. TROLLEY WHEEL; F. C. Schoenthal, Alden, N. Y. App. filed March 30, 1922. Casting of aluminum bronze.

(Issued August 28, 1923)

15,682 (reissue). AUTOMATIC TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. for reissue filed Sept. 10, 1920. Selector apparatus.

1,465,932. MULTIPLEX RADIO-TELEGRAPH SYSTEM; E. H. Colpitts, East Ornage, N. J. App. filed Sept. 11, 1915. Method of overcoming difficulty of making and breaking large power currents.

1,465,961 and 1,465,962. WIRELESS SIGNALING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed April 19, 1916. Overcoming static disturbances.

1,465,972. TRANSMISSION-REGULATING CIRCUITS; George Crisson, Hackensack, N. J. App. filed March 7, 1921. For communication lines.

1,465,985. ELECTRICAL SWITCH INCLOSURE OR CABINET; B. D. Horton, Detroit, Mich. App. filed May 26, 1922. Means for holding grounding lug.

1,465,995. ELECTRIC COOKING AND HEATING APPARATUS; R. E. Pearson, Yonkers, N. Y. App. filed March 16, 1922. Cooking element water-tight so that utensil may be immersed in water to be cleaned.

1,466,013. ELECTRODE STEAM BOILER; Jacob Buchli, Baden, Switzerland. App. filed June 2, 1921. Method of eliminating steam bubbles from electrodes.

1,466,033. METHOD OF MANUFACTURING FILIGREE METAL LAMP SHADES; A. E. Shepherd, Flint, and E. G. Lovering, Detroit, Mich. App. filed March 11, 1922. By electrical deposition of metal over non-metallic filigree backing.

1,466,036. SPEED-CONTROLLING APPARATUS FOR PRIME MOVERS; J. G. Aceves, New York, N. Y. App. filed Oct. 15, 1919. By means of counter-torque device.

1,466,069. MEANS FOR AND METHOD OF REDUCING CAPACITY-CURRENT LOSSES IN ELECTRIC CABLES; A. M. Taylor, Birmingham, England. App. filed April 7, 1923.

1,466,110. SYSTEM OF STREET LIGHTING AND APPARATUS THEREFOR; C. G. Beckwith, Cleveland, and W. E. Davis, Lakewood, Ohio. App. filed Nov. 17, 1919. Lighting of streets and roadways where posts stand close to roadways.

1,466,111. ELECTRIC HEATER; Julius A. Berninghaus, St. Louis, Mo. App. filed Jan. 21, 1922. Reflector type with means for forcing heated air into room.

1,466,124. MEASURED-SERVICE TELEPHONE SYSTEM; E. D. Fales, Western Springs, Ill. App. filed June 14, 1919. Arrangements for automatically controlling coin-collecting device.

1,466,126. ELECTROLYTIC REFINING OR DEPOSITING OF TIN; Colin G. Fink, Yonkers, N. Y. App. filed Feb. 1, 1922.

1,466,139. TRAVELER'S SET; David Michie, Irwin, Pa. App. filed Dec. 7, 1922. Electric iron and cooking equipment.

1,466,158. TELEPHONE EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed March 27, 1919. Connections established with devices including selectively operable switches.

1,466,198. ELECTRICALLY HEATED WAFFLE IRON; William Sickinger, Chicago, Ill. App. filed July 21, 1921.

1,466,208. ROTATING ELECTRODE CLOSED TREATER FOR PETROLEUM EMULSIONS; H. C. Eddy, Los Angeles, Cal. App. filed Feb. 28, 1921. For separating water from petroleum.

1,466,209. IGNITION SYSTEM; Herman W. Eichbaum, Venice, Cal. App. filed Sept. 15, 1919.

1,466,220. AUTOMOBILE SIGNAL DEVICE; J. B. Young, Oakland, Cal. App. filed Oct. 1, 1920. Rear direction signal.

1,466,232. SPARK INDICATOR AND AMPLIFIER; Bassett Jones, Mahwah, and James T. Holmes, Bogota, N. J. App. filed March 12, 1920.

1,466,233. TELEPHONE SYSTEM; C. W. Keckler, Newark, N. J. App. filed Oct. 21, 1919. Method of making connections between lines terminating at manual and automatic exchanges.

1,466,234. TELEGRAPH SYSTEM; M. B. Kerr, Rosebank, N. Y. App. filed Feb. 1, 1922. Synchronous multiplex apparatus.

1,466,253. VENTILATING SYSTEM FOR REACTANCE COILS; M. E. Skinner, Wilkinsburg, Pa. App. filed Sept. 11, 1920. By series of baffles.

1,466,258. ELECTRICAL REGULATOR; A. A. Tirrill, Pittsburgh, Pa. App. filed Dec. 20, 1918. Increasing working range of relays of voltage regulators.

1,466,260. ELECTRICAL PROTECTIVE DEVICE; R. J. Wensley, Edgewood Park, Pa. App. filed April 4, 1918. Frequency responsive relays for use with induction motors.

1,466,263. HIGH-FREQUENCY SIGNALING SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed April 10, 1922. System for producing interrupted continuous high-frequency signaling currents.

1,466,277. PHASE BALANCER; C. Le G. Fortescue, Pittsburgh, Pa. App. filed April 4, 1919. Special auxiliary machine furnishes exciting currents to alternators.

1,466,284. DETECTING SYSTEM; J. B. Harlow, Upper Montclair, N. J. App. filed June 24, 1919. For detecting presence of marine or submarine vessels.

1,466,285. CONTROL SYSTEM; A. L. Harvey, Wilkinsburg, Pa. App. filed Jan. 16, 1920. Reversing control and apparatus for dynamic braking.

1,466,287. SYSTEM OF CONTROL; R. E. Hellmund, Swissvale, Pa. App. filed March 11, 1919. Speed regulation or power-factor adjustment of single-phase commutator motors.

1,466,288. CONTROL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed May 12, 1919. Automatic accelerating and reversing apparatus.

1,466,293. RHEOSTAT; W. L. Brooks, Schenectady, N. Y. App. filed Dec. 27, 1921. Multiple-unit rheostats for tube-filament control.

1,466,304. DYNAMO-ELECTRIC MACHINE; P. A. Koch (deceased), Charlottenburg, Germany. App. filed May 9, 1922. Effective flux varies directly in proportion to ampere-turns producing it.

1,466,307. SYSTEM OF GENERATING AND DISTRIBUTING ELECTRIC CURRENTS; L. J. Le Pontois, Lakewood, Ohio. App. filed June 28, 1915. Automobile generator for charging batteries and for ignition.

1,466,310. SEPARATOR; M. R. Mann, Portland, Ore. App. filed Jan. 14, 1922. For separating metal particles from grain.

1,466,327. ADVERTISING DEVICE; T. R. Wiwi, Chicago, Ill. App. filed Dec. 10, 1921. Traveling-tape type.

1,466,350. FLASHLIGHT; E. R. Barany, Brooklyn, N. Y. App. filed July 8, 1922. Double-ended flashlight.

1,466,351. CONNECTING HEAD FOR MULTIPLE TELEPHONE AND OTHER CIRCUITS; F. G. Brockett and C. C. Wright, Chicago, Ill. App. filed April 5, 1922. For connecting any number of receivers to wireless apparatus.